TRANSACTIONS

OF THE

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

VOLUME XVIII

TRANSACTIONS

OF THE

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

Thirty-Seventh Annual Meeting held at
The Shoreham Hotel, Washington, D. C.

May 4–5, 1925

Vol. XVIII

Published for the Association by
The Williams & Wilkins Company
Baltimore, Maryland

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DESTRUCTIVE LESIONS OF THE FEMALE URETHRA IN CHILDHOOD

A DIFFERENTIAL DIAGNOSIS FROM FEMALE HYPOSPADIAS

ARTHUR B. CECIL

Los Angeles, California

Received for publication June 15, 1925

This paper dealing with destructive lesions of the female urethra in childhood and of the differential diagnosis from female hypospadias, is the fourth in a series of closely related studies, three of which have already been presented before this Association; namely, the subject of hypospadias in boys by Hagner, epispadias in boys, by Young, and epispadias in girls, by Lower. Female hypospadias is a term applied to certain congenital defects of the female urethra in which there is an absence of the urethra, in whole or in part. It is of extremely rare occurrence and has been confused with cases of pseudo female hermaphrodism and with traumatic destruction of the female urethra occurring early in life.

On October 2, 1923, there was brought to the Los Angeles Children's Hospital a Mexican child eleven years old. The child's mother stated that her clothes were constantly wet by day and that the bed was constantly wet at night. It was not possible for me to determine whether this incontinence had been present from birth or not, but when the child was four years old she was taken with severe pain in the bladder region which lasted for several months. The urine had a very foul odor but no blood was seen. The child seemed indisposed to walk, and spent most of the time crawling around. When she was four years and eight months old she passed a large stone, which from the mother's description was probably about 3 cm. long and 1.5 cm. wide.

The child then seemed to rapidly recover. The mother stated she had had great difficulty previous to this illness in looking after the child in regard to urination, as her clothes were wet most of the time. The patient was one of fifteen children, eight of which are living. Four were stillborn, all before the sixth month of pregnancy. There was no history of congenital defects in either the father or the mother. All the other children were normally formed. This child was a full term baby. The mother was well during the entire pregnancy except for some nausea the first two months. When the child was born she was a healthy looking baby and probably weighed about 7½ pounds.

Examination showed a well nourished and mentally well developed girl weighing 67 pounds. *Head:* The pupils were equal; reacted to light and accommodation. Sclerae were clear. Ears negative. The tongue protruded in midline, clean. Teeth negative. No glandular enlargement. Tonsils were enlarged and cryptic. The epiglottis could be clearly seen extending up about one and a half centimeters into the nasopharnyx. No enlargement of the thyroid. *Chest:* Breasts were well developed for a child of her age. Chest well formed. Costal angle 90. Expansion free and equal. Vocal fremitus well felt throughout fronts and backs. Chest everywhere clear on auscultation and percussion. *Heart:* Point of maximum impulse felt in fifth interspace a little mesian to left mammary line. Relative cardiac dullness not increased. Heart sounds clear at apex and base. Pulse 92, slightly irregular in force and rhythm. *Abdomen:* Well formed. Respiratory wave swept over it. No tenderness or muscle spasm. Liver, spleen and kidneys were not palpable. No masses felt. *Reflexes:* Knee kicks were present.

It was noted that the child habitually kept the thighs firmly adducted and when told to walk inclined to walk with as limited a motion of the thighs as possible, and even ran in this manner. Urine constantly dripped from the vulva, both on lying and when walking, and surrounding the vulva the skin was excoriated showing numerous blebs. It was with considerable difficulty that it was possible to get the child to relax the thighs sufficiently to examine the genitalia. The labia were held firmly together. Examination showed a normal clitoris. Labia minora were normal. No evidence of a hymen whatsoever. Anteriorly the external urethral orifice was seen in normal position. Upon passing a soft rubber catheter into the external urethral orifice, the catheter made its appearance in the vagina (fig. 1). With a speculum it was found that the urethra, from the external

urethral orifice, extended back for 1.5 cm. The urethra was of normal size and would easily permit the passage of a No. 14 catheter. There was nothing abnormal about the external urethral orifice. For about one centimeter it was of normal thickness, but near the vaginal portion became thinner and almost web-like. The inner portion of the urethra sprang up from the anterior vaginal wall. At this point the edges of the urethra were excortiated, and urinary salts were adhering to it.

FIG. 1. CUT SHOWING VULVA OF CASE PRESENTED

Back of this anterior portion of the urethra there was no vestige of the urethra whatever, except for a change in color of a strip of the anterior vaginal wall. There were no lateral walls nor any tags nor evidence of scar.

With a speculum it was determined that about 2.5 cm. back in the vagina there was a round opening in the bladder wall directly into the vagina. This opening was about the size of a 32 F. sound. Its edges

were thin, showed no power to retain urine whatever, remained constantly open and the whitish bladder wall could be seen flapping against it (fig. 2). Urine constantly dribbled out of the opening. It was

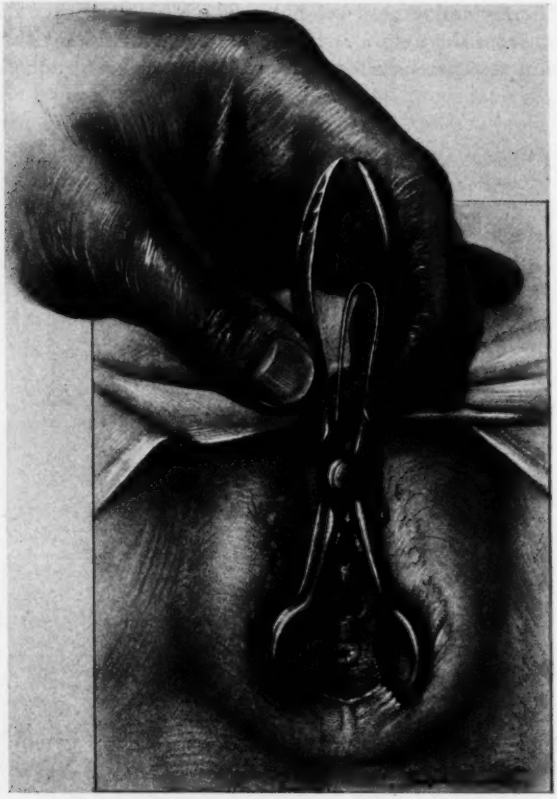

FIG. 2. SHOWING TOTAL ABSENCE OF THE URETHRA EXCEPT IN THE REGION OF THE EXTERNAL ORIFICE

possible to easily introduce the index finger into the vagina. The vagina showed just above the internal urethral orifice a constriction which would not permit the easy passage of the finger, and no further attempt was made to do so. It was possible to collect a very small

amount of urine by catheter. This was of clear yellow color. Negative for albumen and sugar. No pus cells. It was not infected. A blood Wassermann test was negative.

Operation. Case no. 23-1695. L. R. December 4, 1923. The vagina was dilated so that a posterior retractor could be introduced and a good view obtained of the vesical neck. A small curved instrument such as shown in figure 3 was introduced through the vesical orifice, and using this as a tractor the vesical neck was brought forward. The mucosa was then denuded for about 0.75 cm. posteriorly around the vesical orifice and on each side. Then by means of fine sutures dipping well into the tissues, the vesical neck was brought from side to side together in a posterior-anterior direction. This tightened the vesical neck so that a No. 10 catheter was now tightly gripped when introduced. The catheter was tied in. Catheter drained well following this procedure. The catheter was kept in for four days only, as it was thought better not to keep a foreign body at the site of the wound.

Patient was discharged from the hospital on December 26, 1923. As a result of this procedure the vesical neck was found to be considerably tightened, but the child was still unable to retain urine when walking, and there was undoubtedly leakage of urine into the vagina when lying in bed. She was re-admitted to the hospital on February 2, 1924, and on February 12 a horse-shoe-like denudation was done around the urethra, the mucosa being sutured about a small catheter to form a tube, and then by other sutures the deeper tissues were brought together over this, much as in the first operation, but at this time the denudation was carried much farther forward (fig. 4). At this operation the catheter was left in six days, when it was removed. Following this it was found that the patient for the first time knew when she wanted to urinate, and would ask for a urinal in which to pass urine. Urine was then voided in quantities, as much as 120 cc. Discharged from the hospital on February 23, 1924.

Following this second operation the child now found it possible to go to school and maintain dry clothing throughout the school hours. Examination with a speculum showed that the urethra was quite tightly brought together, and with a speculum introduced into the vagina there was undoubtedly leakage if the vagina were dilated, but by means of the new formed urethra together with the muscles of the vagina, the patient was able to run, jump, and lead a normal life without wetting her clothing.

On account of what seemed to be a vagino-urethral control, I de-

termined to have the child re-admitted to the Children's hospital for examination. She was admitted this time on October 30, 1924, and discharged November 8, 1924. Careful observation was made of her

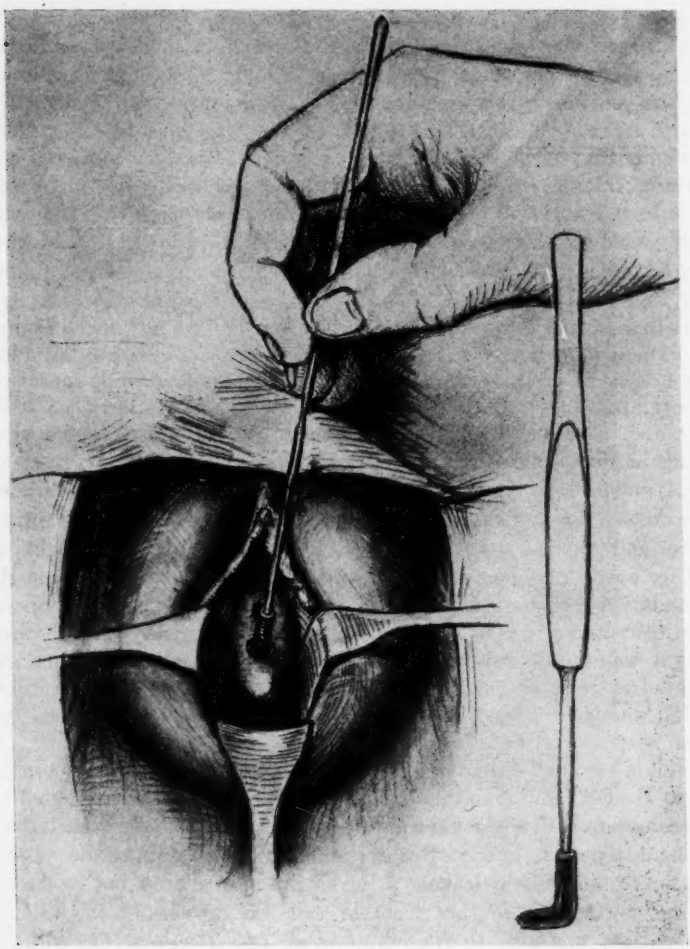

FIG. 3. EXPOSURE OF URETHRA SHOWING THE ELEVATION OF THE VAGINAL WALL BEFORE DENUDATION

to determine whether she wet the bed during the night, as to quantity passed during the day and as to frequency of urination. During this period of time in the hospital it was found that she did not wet the bed

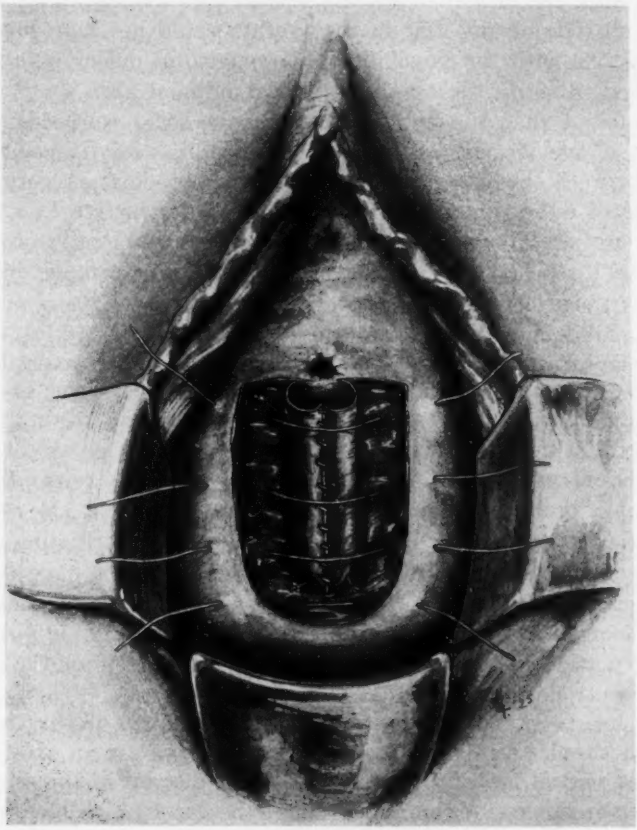

FIG. 4. SHOWING METHOD BY WHICH THE VESICAL NECK WAS DRAWN TOGETHER AFTER A URETHRA HAD BEEN FORMED BY ROLLING UP THE VAGINAL WALL FROM EACH SIDE

at night nor did she wet her clothes during the day. She would get up during the night and void. The amount varied, but was usually about 150 cc. During the day she would at times void as much as 250 cc.

Previous to carrying out the operative procedure, I determined to review the literature of similar conditions for the purpose of determining what type of operation had been used, and while the history of trauma seemed very evident in my case, the absence of any scar in the urethra could not help but impress one with the possibility of a congenital defect, so that I wished to study the case from this standpoint also.

I found that the entire literature was most confusing, and that if one wishes to study similar conditions it is necessary to turn to the literature on female hypospadias, as very few cases of either female hypospadias or of destructive lesions of the urethra in childhood have been described, and from my study I reached the conclusion that a fair percentage of the cases which had been described as female hypospadias were not congenital in origin, but were due to trauma. A study of the development of the female urethra and female genitalia is essential for the clear understanding of these conditions, and for the differentiation of traumatic destructions of the urethra from congenital defects.

The term hypospadias when employed with reference to females, probably originated in the assumption that the fissure of the lower surface of the female urethra was anatomically equivalent to the fissure of the lower surface of the male penis. Genetically, the two represent entirely different developments, the female urethra having its counterpart in the male only in that portion of the male urethra which extends from the prostatic utricle to the internal vesical sphincter.

It has been generally assumed that the female urethra has a much simpler formation in that it represents only an extension of the vesical neck brought about by the descent of the septum vesico-vaginale. A contemplation of the cases which have been repeated under the term female hypospadias necessitates the conclusion that either the female urethra does not have so simple a development as has heretofore been commonly attributed to it, or that it may have shared in the peculiarities of development which produce the features of hermaphrodism so commonly associated with a hypospadic urethra, or that many

of the cases which have been described as female hypospadias are of traumatic rather than congenital origin.

While the term female hypospadias has been applied to a wide variation of quite dissimilar congenital defects of the female urethra, and while some authorities have objected to the use of the term female hypospadias altogether, on the ground that in comparison with the male all females are hypospadic, the term has now established itself and leads to no confusion. As a preliminary to the discussion of the various theories as to the congenital origin of female hypospadias, it would seem appropriate to briefly review the generally accepted views as to the development of the female urethra.

While the dorsal third of the cloaca is being separated off by the septum uro-rectal, the ventral portion is being divided into bladder, urethra, and urogenital sinus. After the second month the upper portion which forms the bladder and which is continuous with the allantois, becomes more sac-like, while the allantois degenerates into a solid cord, extending from the apex of the bladder to the umbilicus. The urogenital ducts are now taken up into the walls of the bladder, and in embryos of 14 mm. the Wolffian ducts and the ureters open separately. After the bladder begins to enlarge, the adjacent portion of the urogenital sinus becomes slightly constricted. This marks the beginning of the urethra. In the female, the constricted part represents practically the entire urethra. The urogenital sinus is narrow at its junction with the urethra; more distally it is wider, and is shut off from the exterior by the cloacal membrane.

When the embryo reaches a length of 17 mm., the membrane ruptures and the sinus opens on the surface. The narrow part of the sinus is gradually taken up into the wider, resulting in the formation of the vestibule. In embryos of 22 mm. there is a fusion of the right and left Müllerian ducts. At first each has in the interior its own medial wall. Later the two medial walls fuse to form a septum, and this in turn becomes resorbed. The resulting canal is termed the utero-vaginal canal. It runs vertically downwards, parallel to the posterior surface of the bladder and urethra, bends almost at right angles at the level

of Muller's tubercle, and accordingly at the boundary between the urethra and the urogenital sinus, forming a horizontal portion, and opens into the urogenital sinus. The actual breaking through of the fused Müllerian ducts with the urogenital sinus first takes place in embryos of 70 mm., head-foot length. The septum which separates the primitive vagina from the bladder is known as the septum vesico-vaginale, and the

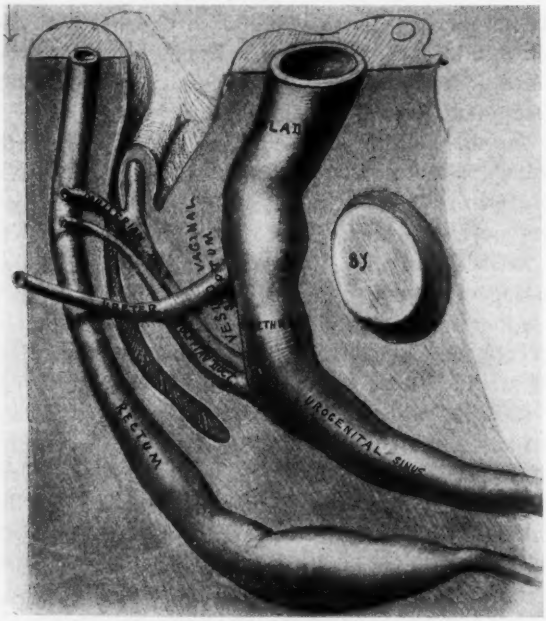

FIG. 5. RECONSTRUCTION OF THE CLOACAL STRUCTURES IN AN EMBRYO OF 25 MM.

generally accepted theory of the occurrence of female hypospadias is that arrest of development occurs at this stage, and that by the arrest of the descent of the septum vesico-vaginale, the urethra is left without a floor (figs. 5 and 6).

This simple explanation for female hypospadias is not sufficient to explain all of the apparent congenital variations encountered. If the female urethra represents simply an extension of the

vesical neck brought about by descent of the septum vesico-vaginale, one cannot then logically explain any cases, such as the one presented by Schauta, and my own case in which there is an external urethral orifice with a defect of any portion of the urethra above this, and it seems to me that all such cases, irrespective of history or findings, must be traumatic in origin.

For the explanation of such cases, however, Teller inclines to

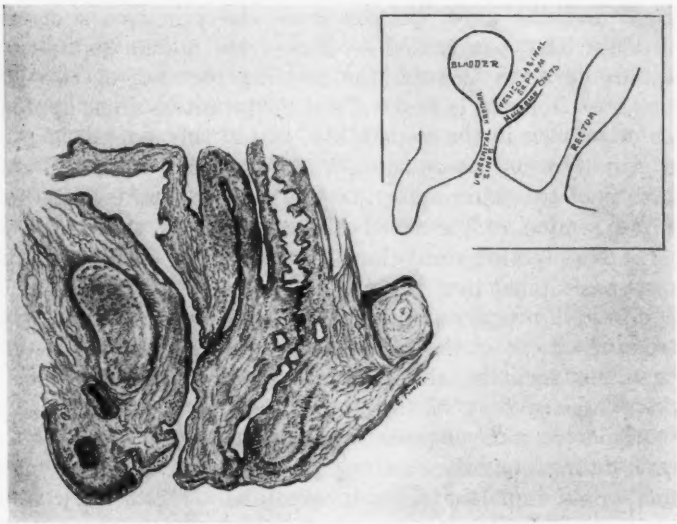

FIG. 6. SECTION THROUGH EMBRYO SHOWING LONG UROGENITAL SINUS INTO WHICH THE URETHRA AND PRIMITIVE VAGINA EMPTY BEFORE THE DESCENT OF THE VESICO-VAGINAL SEPTUM

the views of Fischl. According to this theory, female hypospadias is explained on the basis that first of all the septum urethro-vaginalis did not develop as well as usual, so that the urethra and vagina remained closer to each other than usual. He states that in embryos of 10 cm. small diverticula can be found branching out from a posterior urethral wall, and if these fuse with the vaginal wall and then break through, an opening is formed between the urethra and vagina. If the fusion takes

place to a slight extent only, a longitudinal fissure may be formed. If, however, the fusion and breaking through extends forward as far as the external urethral orifice, a semi-canal results, with its opening towards the vagina and extending toward the urethral orifice, and all gradations of female hypospadias may thus be explained.

Bolk believes that the human urethra is of two-fold origin; that the upper portion arises from the common bladder urethra region, and the lower portion from the primitive sinus urogenitalis. That the caudal section of the human septum urogenitalis develops through the growing together of two folds which arise from the lateral walls of the primitive sinus, approach each other, fuse in the median line, and in this manner lengthen the primitive septum downward. He believes that the human vagina is of two-fold origin; that the greater part develops from a lower section of the fused Müllerian ducts; that the lower smaller part, perhaps one-third, can be traced to the primitive sinus urogenitalis; that the vestibule represents only a part of the primitive urogenital sinus. He believes that female hypospadias results from the failure of the lateral folds of the sinus urogenitalis to unite, and that in cases in which the vagina is lacking, the opening of the normally developed hymen which he considers as a development of the sinus urogenitalis, and that the cul-de-sac found in some cases is that portion of the vagina which arises from the sinus urogenitalis. This theory would explain a great many cases of female hypospadias, but the theory itself has not been substantiated by embryological investigation.

Frattan believes that cases of female hypospadias in which the urethra is split, and in which other abnormalities are absent, are to be explained embryologically as due to a premature disappearance of the distal extremity of one of the Wolffian ducts. This would entail as a consequence a limited gap in the corresponding tract of the periphery of the Müllerian duct of the same side.

Kermauner explains female hypospadias under a somewhat similar hypothesis. He believes that the primary develop-

mental disturbance is found in the caudal ends of the Wolffian ducts, and states that this would explain the asymmetric division or the unilateral defects, such as described in certain cases. This author cites R. Meyer who reported a case in which the vagina opened into the lower section of the rear wall of the urethra. At the same time the left Wolffian duct was dilated into a cyst, its end was closed, and it received the left ureter. He thinks the hypospadias in this case was explained by interference with the downward growth of the Wolffian ducts. Depending upon the time in which this interference with the Wolffian ducts' growth took place, the varying degrees of female hypospadias would be explained.

According to Nagel, female hypospadias arises when the downward growth of the vaginal region is checked, consequently the formation of the septum urethro-vaginale is hindered. This is especially the case in congenital stunting and atresia of the internal genitalia in which the arrest of development has set in before the beginning of the longitudinal growth of the vagina. The arrest causes a persistence of the urogenital canal and forms a short cul-de-sac in the floor of which opens the short urethra and the vagina. The later the arrest has set in and the less intensively it has acted, the shorter is the urogenital canal and the longer is the septum urethro-vaginale. This latter theory is the one which seems to have the greatest amount of embryological investigation in its favor. The other theories have apparently been devised to explain various abnormalities and apparent abnormalities met with. I have been able to find in literature 47 cases of defects of the female urethra which have been classified as female hypospadias.

For the purpose of study I have divided the cases into two main groups: Those in which there are no associated congenital defects and the entire abnormality is found in the urethra or bladder neck, and those cases in which there are associated congenital defects, usually of the genitalia. In the second group there can be little question as to the congenital origin. The first group requires a much closer scrutiny. It is also of interest to note that it is among the cases of group 1, or closely

allied cases that I have put in group 2, that it has been most often found necessary to make a departure from the accepted views as to the development of the urethra in order to explain the congenital origin. An abstract of the cases belonging to group 1 and which I have been able to discover in literature, is given below.

Group 1. An analysis shows that there have been 13 cases in this group, one of which was observed as an infant and one other was observed as a premature birth specimen. Of the remaining 11 cases the youngest when observed was sixteen years old; the oldest was twenty-four years. In 3 cases the patients were described as adults. In Stoeckel's case, although the age is not given, the patient was an adult. The age would have no particular bearing on the study of our subject were it not that in reviewing these cases, in some instances doubt as to the congenital origin has arisen. Four of the cases had been married; 1 was pregnant; 1 had a nine months old child. In only 1 of the cases in this group was there history of possible trauma. This case was reported by Heppner, in which lithotomy had been done when the child was three years old, in 1845. Heppner was unable to accurately determine as to whether a cutting operation had been done on the child or not, although it was the opinion of the chief of the surgical clinic that no cutting operation for stone had been done in his clinic at that time.

Incontinence of urine was present in 8 cases. In Lebedeff's case and in Frattan's case, incontinence did not occur until after coitus. In the former case incontinence was due to dilatation of a fissure-like opening at the neck of the bladder. Frattan did not think that the penis had dilated the fissure in this case, but attributed the incontinence to the weakening of the bladder wall as a result of intercourse. In no instance in this group was there an external urethral orifice intact, in proper position.

In 2 of the cases, 1 reported by Heppner and 1 by Pettit, there was a fissure at the vesical neck with no evidence of lateral or inferior walls of the urethra. The entire urethra was missing

with the exception of some evidence of urethral mucosa at the roof.

Three cases, 1 reported by Lebedeff, 1 by Mackenrodt and 1 by Frattan, showed fissure of the entire urethra and also the vesical neck. In these cases the walls of the urethra could be easily approximated so as to form a canal. In 2 of Meyrhofer's cases, 1 reported in an adult and the other in a year old infant, there was said to be a short urethra opening into the vagina. Of a somewhat similar nature are the cases reported by Rabliagatti, Bitner, Stoeckel, Teller and Mackenrodt. In these cases, extending from the vesical neck for various lengths was a portion of normal urethra. The rest of the urethra was then fissured so as to form a semi-canal.

In spite of the absence of history of trauma and that traumatic origin as a possibility was considered and ruled out by every observer including the case reported by Heppner, one is forced to the assumption that at least most of the cases in this series were not of congenital origin. Destruction of the urethra may occur early in life, in which instance it may be impossible to obtain a history of trauma. A considerable amount of stress has been laid on the absence of scar in the region of the urethra, but it seems difficult to explain the congenital origin of the tag-like portions of urethra remaining in some of the cases, and apparently considerable trauma occurring early in life may leave no detectable scar. As has been said before, the genetic interpretation in this group of cases is far fetched. The similarity of a large number of cases in group 1 to the case which I have reported casts considerable doubt on the possibility of these cases being of congenital origin. It must be rare that the urethra is destroyed in this manner early in life, but it must also be noted that there are extremely few cases that have been reported similar to this in the literature on female hypospadias.

Group 2. All of the cases in this group not only have urethral defects, but also associated congenital defects. In 11 of the cases the clitoris was abnormally enlarged. In Willigk's case the penis-like clitoris was $2\frac{1}{2}$ inches long, and in Geigenmuller's case, 2 inches long. This associated female hermaphrodism is

quite characteristic, and in some instances has been misleading as to the true sex. In contradistinction to the cases in group 1, one meets with no difficulty in this group of cases in finding a considerable number of cases which had been observed early in life.

Thus Blum in studying specimens in Weichselbaum's clinic in Vienna reports three cases in which there were three specimens from the newborn. Petit reports a case after four years; Smith, one six weeks; Mosengeil, eight years old; Blum, one case ten years of age; Engel, case three weeks old; Geigenmuller, a child, etc.

Incontinence of urine in this group was not a prominent symptom, and usually followed attempts at surgical procedures to make a vagina from a persistent urogenital sinus, or dilatation of this sinus in attempts at intercourse. In the large majority of cases in this group the abnormality consisted in a persistence of the urogenital sinus into which the bladder and vagina communicated. The urogenital sinus was usually found to be a very small opening, but in other instances it was a broader type, more in the form of a cul-de-sac into which the vagina opened. In some instances the vagina was entirely obliterated and was represented only by persistence of the genital cords.

From the study of these cases it seems very questionable as to whether any otherwise normal female who has normal vagina and internal genitalia has ever been proved to be the subject of congenital high-opening or splitting of the urethra, and while the findings may apparently lead one to this conclusion and the history of traumatism may be difficult to obtain, or unobtainable, it would seem that in all such described cases the congenital origin has been open to question.

TREATMENT

Attempts of reconstruction of the urethra in these cases must be extremely variable. Attempts to form a urethra in which there is a persistance of a urogenital sinus are very likely to result in incontinence of urine, and it is doubtful as to whether

attempts to reconstruct the vagina have been of any great value. Similarly in dealing with cases in which the vagina is nearly normal, one should hesitate considerably in cutting the muscles in the vagina in attempting to obtain an exposure of the urethra, and particularly should this be true in cases in which incontinence of urine is present. A high degree of urinary retention may be developed by the vaginal muscles.

Group 1

Bitner: Girl seventeen years. Perfectly well up to seven years. Between then and her tenth year taken with painful urgent frequent urination. Menstruation began at fifteen. Regular. Lasted four days, painful. On account of this various treatments were given. Examination showed a healthy looking girl. Hymen half-moon shaped. Cavity forward. Vagina freely admitted one finger. Posterior wall of urethra for 1.5 cm. missing. Anterior wall covered with normal epithelium and side walls of the canal could be made out. No evidence of scar. Marked vulvovaginitis on account of frequent passage of urine. Portion of remaining urethra about 0.5 cm. long. Under chloroform the finger was passed through this and the bladder inspected. Found to contain 1200 cc. urine, alkaline reaction. Phosphatic crystals. Author considered condition a congenital one. An attempt made to restore urethra and it was thought this benefited patient, but from investigation it does not seem there was incontinence in the first place.

Heppner: Woman twenty-two years old. Married one and one-half years. On admission had a daughter nine months old. Said to have had incontinence from early youth. When three years of age a lithotomy was done. Incontinence previous and following but not constantly. Could retain urine five or six hours when sitting or lying with thighs closed. Always wet bed at night. Incontinence worse as result of confinement. Examination showed vestibule and external genitalia normal. External urethral orifice missing but in the region of the external urethral orifice and to the left of the median line is a papillomatous-like projection about the size of a pea and along the course which would be occupied by the urethra are small folds and other evidences of the urethra. At the vesical neck is a transverse fissure 2 cm. across, through which the index finger can be introduced easily into the bladder cavity. Rear edge of fissure is hard without being exactly callous (fig. 7).

Petit: Grown-up girl in which the exterior of vulva, clitoris and nymphae were well formed. There was lacking the entire urethra and the bladder neck. Urine flowed out through a hole at entrance of vagina which was so wide that the little finger could be inserted.

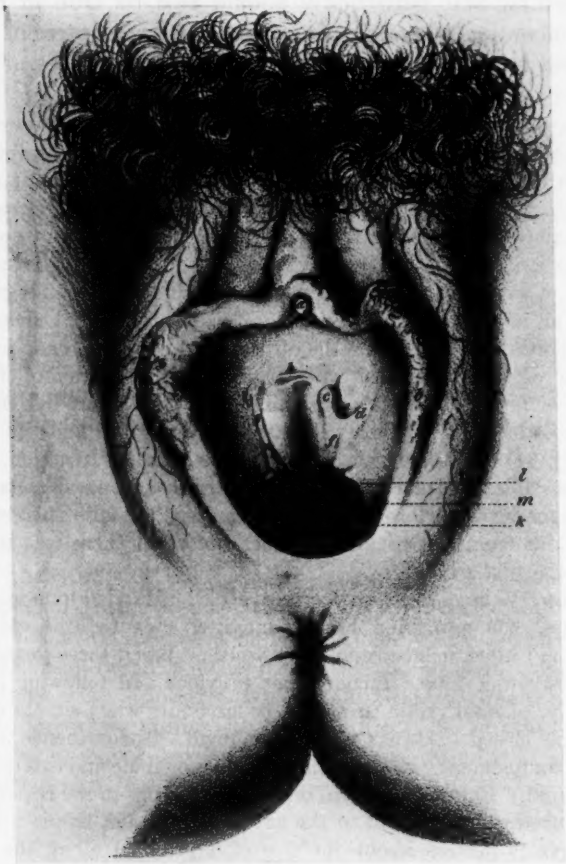

FIG. 7. HEPPNER'S CASE

Lebedeff: Twenty-three years old nullipara, married five years. No urinary disturbances until shortly before admission when incontinence

appeared which is now constant. This occurred first only after coitus or at night. Woman of normal build. External genitalia and vestibule of vagina normal. Hymen in normal position at edge of which

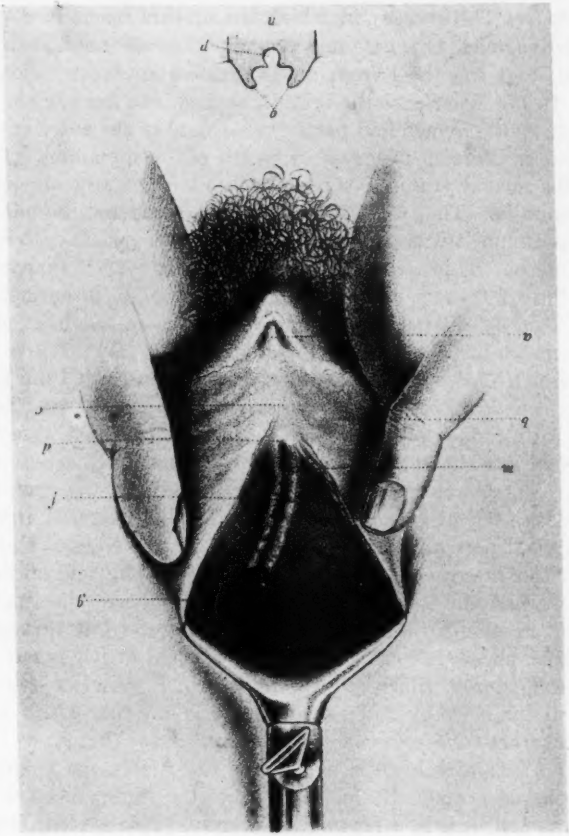

FIG. 8. ILLUSTRATING LEBEDEFF'S CASE

begins a mucous membrane-lined groove which extends toward the bladder for 2 cm. then opens directly into bladder by a hole in the vagina wall which will admit two fingers. Upon separating the anterior edges of the hymen it opens directly into the urethra at the posi-

tion of the external meatus. Apparently no scar formation along the edges of the urethra. The vaginal mucous membrane extended into the bladder. Vagina and uterus negative. No hermaphrodism tendencies (fig. 8).

Meyrhoffer: Three cases in which the urethra opens in a perfectly developed vagina. One case in a pregnant woman; another in a year-old child; and the third from an anatomical specimen belonging to Dittel. In the latter case the urethra opened into the vagina. There is a fissure of the hymen and partial semi-canal of the anterior urethra.

Rabagliati: Woman twenty-four years old complaining of incontinence for several years. No mention is made of any abnormalities of the genitalia. They have therefore been considered normal. With a Sims speculum it was possible to see the upper surface of the urethra for 1½ inches. This appeared red and prolapsed. Apparently the rest of the urethra was normal. Exact cause of incontinence not stated. The deficiency in this case was lack of urethra, inferiorly and anteriorly.

Mackenrodt: Girl, aged twenty-one years, incontinent from infancy. When sixteen years old several unsuccessful operations had been attempted to introduce into the bladder the ureters which were said to have opened into the vagina. Apparently normal external and internal genitalia. There was a fissure on the right side of the urethra and bladder neck. Cystoscopic examination by Nitze showed that both ureters opened normally into the bladder near the edge of the defect and that the interureteric band was normal. The operations that were done when she was sixteen years old had been concerned with the introduction into the bladder of a third ureter but this attempt had not been successful. (Description in original article is not clear.)

Stoeckel: Posterior third of urethra present. Anterior two-thirds represented by a groove. Remnants of the urethra which can be brought together to form a canal. No incontinence (fig. 9).

Ahlfeld: Adult with urethra opening so low within the vagina that the urine flowed not into the vulva but into the vagina as soon as the bladder was emptied, in a recumbent posture. Not evident from the few notes whether this was a case in which there was a high opening of the urethra into the vagina or whether there was between the clitoris and vaginal orifice a suggestion of an external urethral orifice and a semi canal between the vestibule and an abnormal urethral opening as a remnant of the anterior section of the urethra. This case is therefore difficult to classify.

Teller: Sixteen-year-old girl. Incontinence day and night from birth. No parturition. No abortion. Normal female type. External genitalia negative. Hymen preserved but divided into two portions by a transverse tongue. No external urethral meatus but in

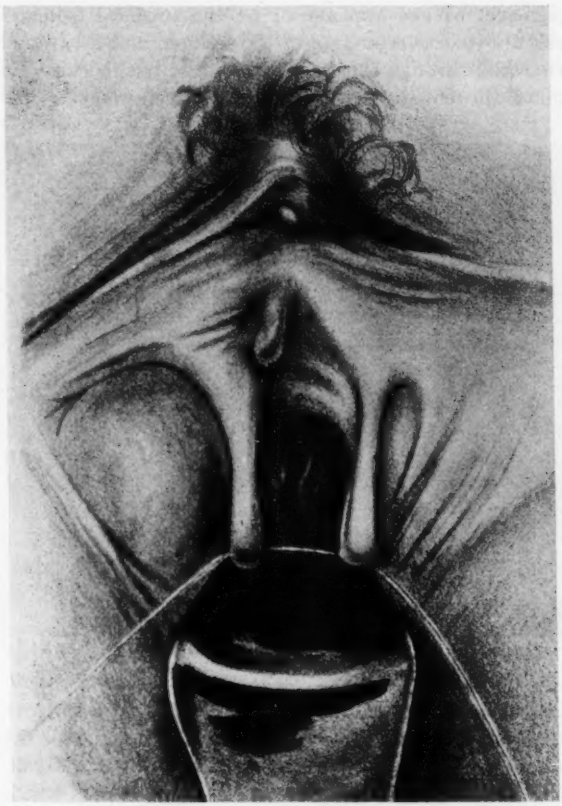

FIG. 9. ILLUSTRATING STOECKEL'S CASE

its place two folds of vaginal mucous membrane. Urethra quite broad. No urethro-vaginal septum. No scar formation could be made out. Cystoscopy shows that the bladder neck is a little broader than normal. Internal genitalia negative. Urethra which is striking in its great

width in its semi canal part. Fissure did not involve the vesical neck (fig. 10).

Frattan: Eighteen-year-old woman. Married five months. Menstruation came on at fifteen. Fifteen days after marriage developed incontinence of urine. Physical examination negative. Internal organs negative. What appears to be the urethral orifice is at its usual place above the remnants of the hymen, and a catheter can be easily introduced through this into the bladder but at closer inspection it was found the entire urethra was fissured throughout its length.

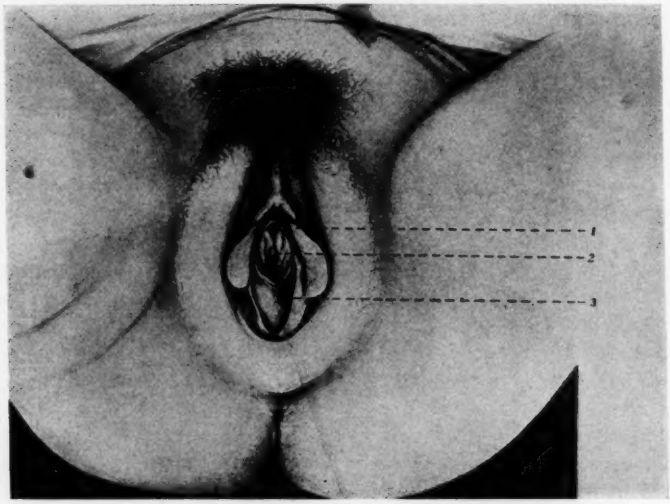

FIG. 10. ILLUSTRATING TELLER'S CASE

Fissure somewhat to right of median line. Edges show no scar alterations and are usually in contact with each other so as to hide the defect. This deep semi-canal is lined with mucous membrane. About 2 cm. from the meatus the urethra expands into a broad sinus which passes directly into the bladder neck and easily admits the index finger. Upper section of the vagina normal in form and dimensions.

Group II

Wilkes: Nullipara. Died in ninetieth year. Widow forty-two years. Complained of frequent and difficult urination only in later life. Ex-

amination showed absence of the urethral orifice and where the vagina should have been was a small opening which admitted only a probe. Through this the urine passed. On dilating this phosphatic calculi were passed. The urine contained blood, clots and much pus. Autopsy showed a thickened contracted bladder containing phosphatic calculi. At the base was a small opening through which a probe could be passed into what appeared to be the vagina. It entered this canal about 1 inch from its orifice. The vagina was much dilated and formed a second bladder, but its orifice was not larger than the opening of the male urethra.

Seligman: Female, aged six years. Incontinence of urine from birth. No history of trauma or operative procedures. Examination showed a strong girl a trifle pale, whose gait is not normal. Labia majora do not join in front but spread out over the mons veneris. Clitoris small. No prepuce. Labia minora normal. Decreased thickness of tissues between anus and vagina. Rectal examination showed a uterus biparititus which connected with the vagina only by loose cellular tissue. Vagina very small. Instead of the normally opening urethra in the vagina there is a wide opening which runs into a medium sized canal and upon passing the catheter through this opening it immediately enters the bladder. This opening was so large as to admit the finger, and the bladder wall could be seen flapping into the canal. A plastic operation was attempted, and following this the child was able to hold the urine while lying and with the legs pressed together, also while walking with the thighs held together, but if the thighs were separated the urine began to flow at once. Author considered this a case of congenital malformation.

Busch: Cites a case in which a woman gave birth to a normally formed girl, and in addition, an abortion with head, chest and arms, but the center was common to both. The abdomen of this abnormal specimen showed four orifices: the navel, vagina, anus, and rudiments of the eyes over the navel. There was a fissured urethra back of the hymen opening into the vagina.

Cusco: A woman eighteen years of age. No menstruation. Died from operation for strangulated hernia. Examination showed a greatly enlarged urethral orifice from which it was easy to enter the bladder. The posterior wall of the urethra, or persistent urogenital sinus, showed an opening 1.5 mm. wide which led to a short, blind sac (rudimentary vagina). There were abnormalities of the uterus and tubes. The ovaries were present.

Engel: Specimen from Vienna Anatomical Museum. Three weeks old. Hermaphroditic infant. Penis-like clitoris. Persistence of urogenital sinus. External opening scarcely large enough to admit a moderately large probe. From this opening begins a canal $\frac{1}{8}$ inch long which divides into two branches: a higher one, the urethra, and a lower one, the vagina. Urinary and other sexual organs normal. Vagina very narrow. Opening into the urethra or unrogenital sinus.

Geigenmuller: Female child considered a male for a long time. Clitoris 2 inches long. Ten operations to restore male condition of urethra. Autopsy showed that the ostensible urethra commenced anteriorly with the bladder and posteriorly with the vagina. Uterus and ovaries normal.

Willigk: Woman, died at forty-six. Mistake in sex. Penis-like clitoris $2\frac{1}{2}$ inches long. Persistence of urogenital sinus for 1.5 cm. opening into two canals; an anterior one, the urethra, 1 cm. long, and a posterior one, the vagina 2.1 cm. long. The opening of the vagina at its beginning was 4 mm. in diameter. Tubes and ovaries normal.

Huguier: Adult woman. Fairly broad urogenital sinus into which the vagina opened through a small aperture. Vagina made of uniform caliber by incisions.

Jumne: Woman thirty years of age. In place of the urethra and vagina and openings there was found a hole only the size of a quill. Introduction of a catheter into this opening withdrew urine. Opening was enlarged by lateral incisions. After coitus incontinence of urine set in for a time, possibly due to the entrance of the penis into the bladder. In this case persistent urogenital sinus, the anterior surface of which communicated with the bladder through a fissure-like opening and the floor of which was the unperforated hymen.

Coste: Woman twenty-one years old, single. Penis-like clitoris 4 mm. below the base of which in the angle of two skin folds was a small opening through which urine and menstrual fluid flowed out. Persistent urogenital sinus. Incisions of the opening of the vagina which opened into the urogenital sinus, which allowed copulation.

Arany, Jagemann and Herman have reported cases in which the vagina throughout its extent above its junction with the urogenital sinus was completely obliterated. In all of these cases the urogenital sinus was represented by a broad cul-de-sac, in the anterior wall of which was a passage leading into the bladder. Naturally the development of the internal genitals was for the most part defective.

Szymanowsky: Adult woman, married. Inability to carry out coitus.

Persistent incontinence of urine. Examination showed no vagina or uterus to be made out, but there was a hard body in the position of the left ovary. Incontinence had been produced by splitting of the persistent urogenital sinus. This condition was explained on the basis that the Müllerian threads had remained solid but had connected with the urogenital sinus, so that the single passage represented the urogenital sinus and urethra.

Petit: Four-year-old girl. Clitoris, nymphae and urethra absent, but there was a rather broad vagina. Incontinence of urine.

Langenbeck: Nineteen-year-old girl, never menstruated. Persistent urogenital sinus which at first appeared as a urethra or vagina, the opening was 1 inch lower than normal, Hymen half-moon shape. Opening so small that it permitted the passage of only a small catheter. Urethra and vagina formed a common canal into which the bladder opened directly. Hymen was split and at first the urine flowed out involuntarily, but subsequently incontinence disappeared. No trace of uterus could be found.

Smith: Six-week-old child, supposed at first to be a boy. Clitoris 1 cm. long and below it a triangular opening which discharged urine. Child died. Autopsy showed it to be a female with well developed internal genitals. Canal which lead to the external orifice was not the urethra but the persistent urogenital sinus and its anterior wall received the opening of the bladder without evidence of urethra.

Mosengeil: Eight-year-old girl with incontinence of urine. Rather large clitoris, stunted vagina. No external urethral orifice but in its place a semi-canal which becomes a canal less than 1 cm. in length from the bladder. Author explains incontinence on the basis that a slight filling of the bladder causes the short urethra to vanish on account of weak muscles. Considered a true case of female hypospadias. Did not think it possible to restore sphincter muscles (fig. 11).

Debrow, Debout and Furst have all described cases in which the urethra opened into the anterior vaginal wall and in which the vagina was incompletely developed. (Probably cases of persistent urogenital sinus because they are quoted in connection with definite ones by another author.)

Schauta: Woman aged thirty-one, married eleven years. Menstruation began at seventeen. Small pox at six years, pleurisy at twenty-three. No other illnesses. When married found she was unable to carry out coitus and an unsuccessful attempt was made to broaden the narrow vagina. For three years before admission suffered

with fecal incontinence which appeared after a violent attempt at coitus. No urinary incontinence. External genitalia normal. Clitoris rather prominent. Perineum apparently negative. Vestibule contracts toward the top where it passes into the vagina, funnel fashion. External urethral orifice in normal position, contracted. Will admit catheter of ordinary size. In the rear wall 9 mm. upward from the external urethral orifice is a fissure 11 mm. long and lined with a swollen mucous membrane opening into the vestibule. No scar tissue. On the bridge between this irregular opening and the external urethral orifice is a cone shaped fleshy plug about 8 mm. long, hanging down toward the introitus. No evidence of hymen. About 4 cm. above

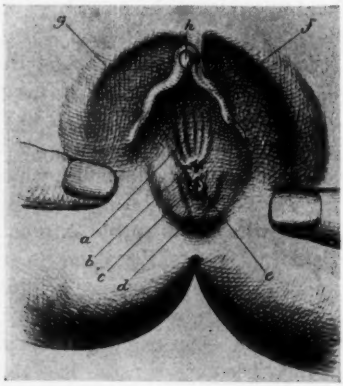

FIG. 11. ILLUSTRATING MOSENGEIL'S CASE

the introitus is a third opening 4 cm. long, which from its direction was thought to be a rudimentary vagina. In this case there was also a two-fold opening of the rectum. Author considered case unique as two urethral orifices were present and felt that the case challenged the usually accepted views of formation of the urethra (fig. 12).

Purslow: Single woman, aged twenty-three. Came for examination. Menstruation commenced at thirteen. Painful, getting worse for three years. No urinary disturbances. Well developed woman. External genitalia and vulva normal. Well marked hymen, immediately within which but distinct from it was a fibrous ring contracting the vagina so that the finger could not be forced through it. The hymen and this contracted portion of the vagina were divided, at the upper

end of which was a capacious vagina, and at the junction between the contracted portion and vagina was an opening into the bladder with no trace of a urethra. The hole in the bladder would admit the end of one finger. (Fissure case, probably persistent urogenital sinus.) Following operation, incontinence of urine which corrected itself some months later.

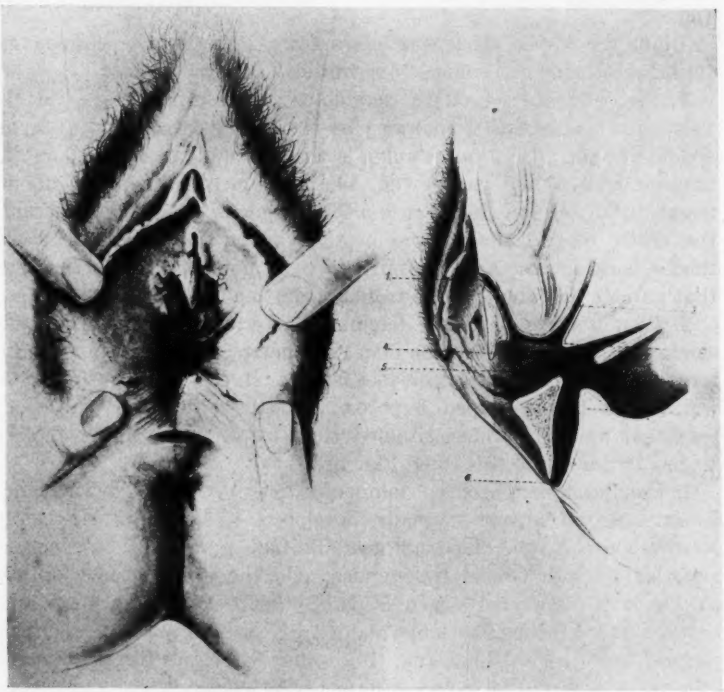

FIG. 12. ILLUSTRATING SCHAUTA'S CASE

Blum: Child, aged ten years. Diurnal incontinence noticed on beginning to walk at fifteen months. No incontinence at night. Complete retention at five years, followed for eight days by painful frequent urination. Retention disappeared. Since age of seven urine very cloudy. Retention again at eight and one-half years. Bladder reached the navel. Treated by catheterization. A little later general septic

infection. Greatly distended bladder. Examination showed a "considerably developed clitoris," funnel-shaped vulva, with no sign of external urethral opening. At the anterior edge of the hymen within which run two very fine parallel folds. Catheter pushed along anterior vaginal wall about 4 cm. withdraws urine. Longitudinal fistula wich extends back behind the margin of the hymen for 1.5 cm. Cystoscopy showed evidence of obstruction. Cause of retention unknown (fig. 13).

Blum reports the following cases from Professor Weichselbaum's Pathological and Anatomical Museum in Vienna:

1. Pseudo hermaphrodism femininus externus. Clitoris is developed penis-like on the inferior part of which is a groove like a hypospadic urethra. Deep in the vulva is the orifice of the urethra on the anterior wall of the vagina (fig. 14). Complete hypospadia of the female urethra. It is not a case of persistent urogenital sinus because the orifice of the urethra and of the vagina are separated. Blum thinks cohabitation and micturition were possible in this case and that patient probably had no trouble from malformation.

2. Pseudo hermaphrodism femininus externus. External genitalia similar to hypospadias in the male. Apparent scrotum empty. Internal genitalia female. Penis-like clitoris on the inferior surface of which is a groove-shaped hypospadic urethra. Urethral orifice or persistent urogenital sinus situated close to the base of the clitoris. Vagina empties into this canal (fig. 15).

3. Pseudo hermaphrodism femininus externus. New born child. Internal sexual organs normally developed. Vagina 2.5 cm. long. Narrow and smooth. External genitalia male type. Well developed glans clitoris surrounded by prepuce. On the lower surface of the clitoris is a semi-canal which leads to the urethral orifice midway between the scrotum like labia majora. Condition exactly resembles perineal male hypospadias (fig. 16). Shows section through genito urinary organs of the child. Uterus, tubes, ovaries well developed. Elongated urethra. Vagina opens into urethra corresponding to the point where the Mullerian ducts enter in fetal life (fig. 17). Cohabitation would have been impossible in this case. Urination probably normal. (Persistent urogenital sinus.)

4. Pseudo hermaphrodism femininus extenus. One-week-old child. Large clitoris $1\frac{1}{2}$ inches long resembling imperforate penis. Prepuce divided into two folds making the labia minora between which is the urethral orifice which leads to a rather wide urethra. Three-fourths

FIG. 13. ILLUSTRATING BLUM'S, NO. 1

FIG. 14. BLUM'S CASE, NO. 2

FIG. 15

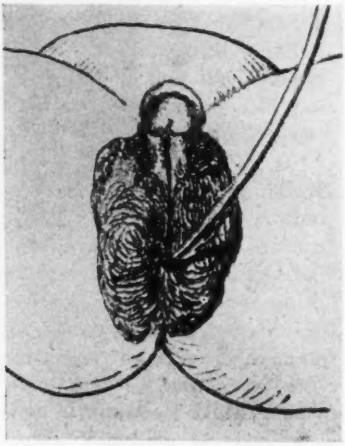

FIG. 16

inch from the external orifice the vagina empties into the rear urethral wall through a ring shaped plicated opening (fig. 18).

5. Persistence of the urogenital sinus. New born girl. Between the swelled labia pudendi bounded by nymphae is a funnel-shaped

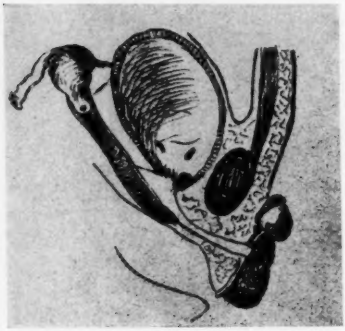

FIG. 17

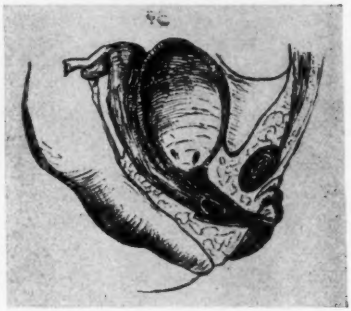

FIG. 18

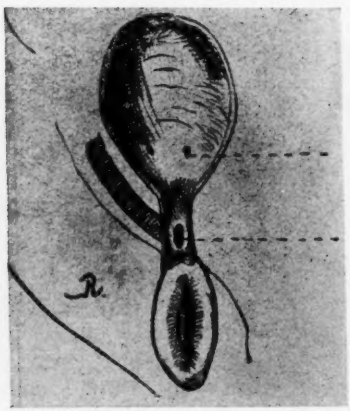

FIG. 19

opening which leads into a canal into which the urethra empties; the canal growing gradually wider toward the rear, continues into the rectum which is contracted to funnel shape. Canal also communicated with a double vagina (fig. 19). In this case there are a number

of defects in the external genitalia. It is necessary to go back in embryology for their explanation to where there is but one common opening in the cloaca, for the intestinal, urinary and genital tracts.

Knight: Woman, aged twenty-one. Married. Never menstruated. Epileptic fits from age of fourteen. Inability to cohabit. External genitalia negative. No external urethral orifice. Upon attempting to pass the finger into the vagina a blind cul-de-sac 2 inches long is found. Just within the vagina is a septum formed by the anterior vaginal wall. Finger can be passed in front of this septum directly into the bladder. Sphincter muscle is present. No uterus could be determined. Breasts well developed.

Bozeman: Adult woman, married. Unable to have intercourse. Vagina terminates in the urethra. Persistent urogenital sinus.

Ptalmey: Married woman, forty-eight years of age. Incontinence of urine for one year. Menstruation began at seventeen. Married at nineteen. Never pregnant. Large clitoris. Labia negative. In place of the vaginal orifice is a funnel-like fossa on the anterior aspect of which is a slight elongated depression or semi canal. The neck of the bladder opens into the bottom of this pit. The opening of the bladder prevents passage of the finest probe. Urethro-vaginal septum is protruding back of this. Vagina opens into a cul-de-sac. Cervix could not be seen. Rudimentary uterus lay anteriorly.

Meyer: Vagina opens into the lower section of the rear wall of the urethra. Persistent urogenital sinus for a 0.5 cm. Left Wolffian duct dilated into a cyst which received the ureter so that the Wolffian duct and ureter in this case have not been disassociated. Hypospadias was thought to be the result of interference with the descent of the Wolffian duct.

Kermauner: External genitalia normal except for perineum. Here a well-defined median raphe which sagitally bisected the perineum and which could be opened up disclosing a groove lined with mucous membrane which continued without interruption into the rectal mucosa. Anus fissured. Urethra in this case represented by semi canal which after splitting the hymen continued for some distance toward the clitoris. Only abnormality of the urethra was the abnormally long slit. This case hardly considered at all except for associated congenital raphe running toward anus.

I have not had the opportunity of reviewing the literature on the following cases which have been reported in some of the

articles which have been reviewed, and perhaps reported fully enough for all practical purposes:

Schneider, Selheim and Virchow have reported examples of persistent urogenital sinus with the urethra and vagina entering into a common opening.

Behnke has reported a case in which there is entire absence of urethra, and in which the bladder communicates with the vagina by means of fissure.

Kussmaul has reported a case in which the hymen was split by a semi-canal but in which the vesical neck was intact.

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COMPLETE AND REPEATED EXTROVERSION OF THE BLADDER THROUGH THE URETHRA, ASSOCIATED WITH DOUBLE RIGHT KIDNEY AND URETER

ROBERT C. BRYAN

Received for publication June 15, 1925

CASE HISTORY

Baby D., female, two and one-half years old, referred to us for painful urination characterized by straining and occasional convulsions. Family history negative except one aunt a mute. Mother, thirty-seven, no miscarriages; father, forty-four, in good health: one brother, seven, perfectly normal. During first six months of life had the eardrums lanced five times for retention of purulent matter. At fifteen months, the baby had trouble with teething and at this time she had six convulsions, she also had one convulsion at the beginning of an attack of measles. No other distinct illnesses other than whooping cough and chicken pox.

November 24, 1924. The tonsils were removed under general anesthetic, she made a good recovery and was allowed to go home in two days.

Friday, November 28, at 6:00 p.m., the child while voiding, as customary, on a vessel began to cry and scream so that her mother lifted her up and saw presenting at the vulva a swelling the size of a large English walnut, which was firm, of a distinctly reddish, tomato-color, soft and velvety. The mother sent for her family physician, Dr. A W. Lewis, who gave the child coloroform and reduced it. In de scribing his visit Dr. Lewis stated the following:

"When the tumor first presented I told the mother I thought it was the bladder, but I had never seen anything like it before. About two years ago when this child was only a few months old, she had symptoms referable to her kidneys, and would strain and cry when she passed her water. Dr. B. B. Bagby, now of Richmond, met me in

consultation and we diagnosed the case as probably hydronephrosis. I sent the child to Richmond to have the kidneys x-rayed; they feared she had developed an otitis media. The drums were ruptured and the pus drained off, but she ran some temperature for months. They came to the conclusion that the ears were the trouble and the kidney was not x-rayed at this time. It is interesting to note that we found the enlargement, at that time, over the kidney that you now find out of commission."

December 1, 1924. This child was brought to Grace Hospital and examination showed her well developed and nourished, but skin quite pale and she seemed anemic. Abdominal examination was negative but for a slight reducible umbilical hernia. The left kidney could be palpated, the right could not be located. There was some redness about the vulva, the veins on either side and running back from the urethral orifice were distended and blue. The urethral mucosa was immediately recognized and the lumen of this tube was apparently considerably larger than it should be in an infant of two and one-half of age.

The child was prepared with an enema and restricted diet for examination the next day. Chloroform anesthesia was administered, the bladder was irrigated, taking a No. 12 French catheter very easily through the urethra. There was a large amount of pus so that irrigation was carried out repeatedly. A Child's No. 12 French cystoscope being introduced visualization was obtained. There were flakes of mucus floating here and there in the medium, and one rather large deposit seen posteriorly. The general appearance was quite different from the usual bladder picture, neither the interureteral bar nor the ureteral ora were located. There was a distinct line running from about the location of the left os well upward and to the left, delineating the whitish mucosa superiorly from the fluffy, edematous, transparent, reddish mucosa seen more anteriorly. This area was found particularly about the floor and one or two small bleeding points were located, there being many hemorrhagic spots scattered here and there. We took this reddish elevated area to represent the line of extrusion which had occurred on Friday, November 28, and was seen by Dr. Lewis. Rectal examination was negative but for a general dilatation of the veins about the anal margin. The palpating rectal finger could be easily felt through the abdominal wall suprapubically. The patient was then taken to the x-ray room, the cystoscope removed, a No. 12 French catheter introduced through the urethra, and 5 ounces of a

25 per cent solution of sodium bromide injected and X-ray taken, which is as follows:

Cystogram shows the bladder full of solution, and the right ureter is extremely dilated, being more than ½ inch in diameter. This evi-

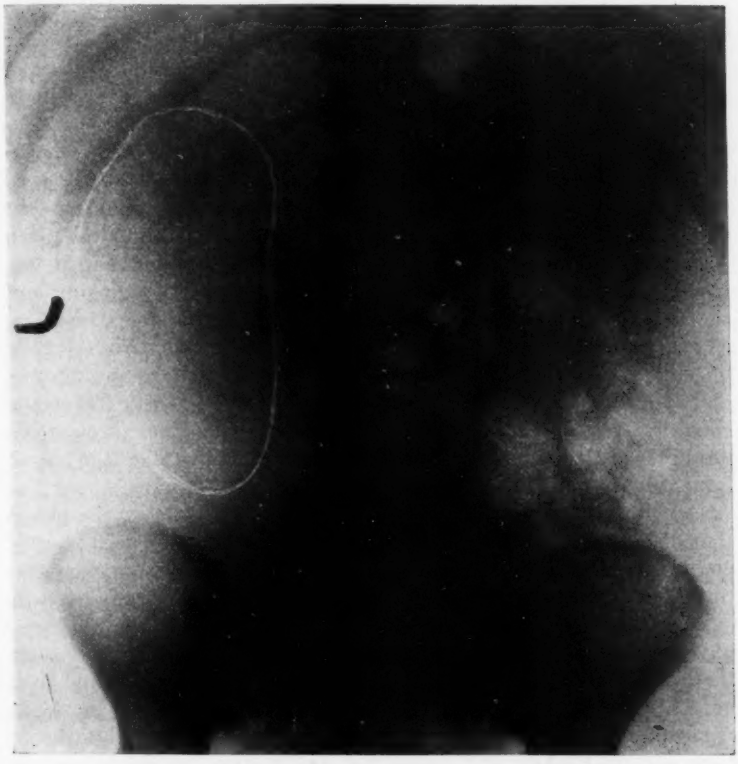

FIG. 1. X-RAY SHOWING THE OUTLINE OF THE VERY LARGE LEFT KIDNEY, NO OUTLINE OF THE RIGHT KIDNEY BEING SEEN

dently extends all the way up to the kidney. The kidney, however, was not shown on the plate.

Laboratory report: *Blood:* Hemoglobin, 75 per cent; red count, 4,360,000; white, 10,200; large mononuclear, 6 per cent; lymphocyte, 37 per cent, neutrophile, 56 per cent, basophile 1 per cent.

Smear: Very slight oligochromenia and anisocystosis.

Urinalysis: Straw, cloudy, acid, albumin 3 plus, sugar negative. Sediment: 4 plus pus, 3 plus blood.

Culture bladder specimen: Colorless cloudy fluid with trace of albumin and 75 to 90 leucocytes per high power field. Few blood cells and larger bacilli. No tubercle bacilli found. Gram stain: Many large gram and bacilli typical of B. subtilis (a contamiation).

December 21. Called hurriedly to see the baby we found a tumor covering the upper part of the vulva the size of a walnut, and slight amount of bright red blood had streaked down the inner aspect of the thighs. The tumor was soft and velvety, varying in color from a bright tomato-red to a dark-bluish, almost plum color, distinctly compressible, and on straining and restlessness the swelling would present even further, becoming as large as a hen's egg. The child was given some chloroform, the surface covered with sterile vaseline and it was reduced with quite some difficulty. It reminded one very much of the reduction of ballooned intestines through an abdominal incision, as one segment is reduced another escapes. In its reduction the little finger was lubricated and put in through the urethra and so on into the bladder, with another finger in the rectum it was decided that the condition was most likely an exvagination of the bladder through the urethral canal. A pad was placed against the vulva, the legs bound firmly together and the child allowed to react.

December 22. At 11:00 p.m., the mother reported over the phone that the swelling had appeared again. The tumor was seen shortly and was not as large as on the first occasion but was red, irregular and rumpled, the color being that of an over-ripe strawberry, and it was evident that the greater part of it was coming from beneath the symphysis, this part being more stretched, glazed and of a lighter color than the under surface which was rumpled up in creases and would then unfold, making the tumor larger as the baby strained. It would reduce in size by a retraction of the under surface carrying the trigone back into the bladder, and would then unfold again, or rather pop out rapidly on straining and gain its fullest size. Under these conditions it was elastic, as if filled with air, tense, compressible, even, symmetrical and on reduction by pressure the floor would disappear first, the swelling becoming immediately less tense; but now, somewhat rumpled and in creases these folds or rugae always running vertically, of a darker color, more velvety, uneven and as it gradually reduced in size it would become more and more rumpled, of a darker color, and finally disap-

pear through the urethra. The little finger, up to the second joint, following the reversed tumor and sweeping around inside of the bladder could again feel velvety folds and gentle irregularities, but no distinct protrusion or evident globular mass. With another finger lubricated and put in the rectum, apparently the normal amount of tissues were again felt between the two palpating fingers. On each occasion that the tumor presented it had been noted that there had been a spurt of heavy, flocculent, purulent urine, which was well upwards and to the right side, and which was evacuated more freely when the tumor was well distended and appeared only as the bladder gained its fullest dilatation. This was taken to be urine caught in the folds and retained by the sharp reflexion of the bladder.

December 23. The baby was again brought to the hospital, and at 4:00 p.m. another examination was made. On account of the very large urethra a No. 24 F. catheterizing cystoscope was used and it was definitely determined for the first time that there are two openings, the left ureter being in its normal position, and just to its right side, and slightly anteriorly, about 0.5 cm. away, there was another opening of a very much larger size, probably 1 to 1.5 cm., both of these openings are catheterized by metal instruments and after their intromission there was no click of contact. During this manipulation and tickling of the bladder the extroversion occurred again. The mode of eversion was definitely witnessed, and it was evident that the anterior wall was extroverted first, this was uniformly followed by the fundus of the bladder and then the posterior wall and floor of the bladder and the trigone. This anatomical unfolding was clearly demonstrated and identified, as on three occasions the tumor presented and on three occasions it was reduced. On the third eversion, a No. 12 French catheter was placed over the tumor as it was reduced to reassure ourselves that it was the entire bladder being extroverted and not a partial vesical extrusion, exvaginated diverticulum or marked ureterocele. On the reduction of the tumor the catheter was found in the urethra and the little finger following the catheter upwards found it curled about snugly in the bladder. With the cystoscope a No. 6 French catheter was now put into the larger ureteral opening and it was strapped to the thigh with adhesive, with the hope of obtaining the contents of the right kidney. This was unsuccessful, as the baby pulled it out in about an hour, despite considerable attention to the contrary, no urinary products having been obtained.

December 27. During the past four days the tumor has come down

on frequent occasions, and during the night of the 26th it came down three times and had to be reduced under chloroform on two occasions. The temperature, however, had been better, the highest being 102.3, it having been to 105. At 9:00 a.m. on the 27th the bladder everted again and it was apparently more congested than on former occasions but was reduced. The baby was now prepared for cystoscopy and catheterization of the ureters, and when under chloroform anesthesia, the eversion occurred again, presenting as on former occasions, in the usual sequence of the superior wall of the bladder, fundus, floor and trigone, the mucosa being intensely congested, with bluish hemorrhagic

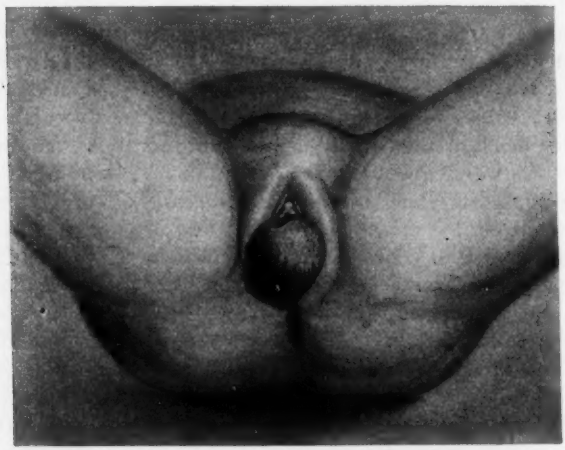

FIG. 2. DRAWING OF THE TUMOR AS PRESENTING AT THE VULVA
At this time the ureteral ora had not been seen

spots and considerable thickening showing here and there. The bladder was elevated, held up towards the symphysis and folded back on itself to get a better view of the under surface, so that the everted trigone was now plainly visible and immediately identified, and from the left normal ureteral os urine was seen spurting as in a vertible exstrophy of the bladder. It was catheterized easily, there being no resistance to a No. 4 French catheter, which mounted nicely to the pelvis of the kidney and through which there was an immediate flow of light colored urine containing only a few flakes. The right os was very long, about 1 to 1.5 cm., slit-like, slightly nearer the mesial line,

the slit running from about 11 o'clock to 5 o'clock, and 0.5 cm. from the normal left opening and slightly anterior to it. This was catheterized with a No. 6 French ureteral catheter but apparently it curled on itself not having had a satisfactory intromission. These are the two openings which we had recognized on our second cystoscopy. The tumor was now carefully reduced carrying the two inserted ureteral catheters, and an attempt made for further introduction of the right ureteral catheter to obtain another and better pyelogram. We did not think it wise to do a left pyelogram as the appearance of the urine indicated a healthy left kidney and it was certain that we were doing quite enough to the right side. Having now reduced the bladder, with the catheters, in what we took to be the right and left ureters, a No. 24 French cystoscope was inserted and these catheters were seen indistinctly through the cloudy field, entering the ureteral mouths, but the bladder had none of the appearance of our first cystoscopy!

December 27. The eversion occurred eleven times in the twenty-four hours so that it was deemed advisable to put something in the bladder to try to retain it in position. A rubber finger cot was tied securely over a catheter, this was put in the bladder and the cot blown up to the size of one's thumb. This worked well for three hours and was then forcibly expelled. A Pezzar catheter was now put in the bladder and worked satisfactorily for six hours throughout the night of December 27, draining nicely, and through which the bladder was irrigated at intervals with boric acid solution. This, however, was expelled on subsequent occasions so that it was replaced four times during the night of December 28. We now secured the largest Pezzar catheter and it worked splendidly.

December 28. Two attempts to get the phenolsulphonephthalein test were unavailing, a section of a rubber glove being tied to the lower end of the Pezzar catheter so that there would be a constant collection of the urine, but the catheter coming out this was not successful. The very satisfactory ureterogram forcibly demonstrating the great size of the right ureter we were constantly on our guard and looking for an ureterocele, which, acting as a wedge, would have explained the enormous dilatation of the urethra, and, continuing in its intensity, would have produced the eversion of the bladder. No such tumor, unevenness or protrusion was ever seen by either the cystoscope or by direct examination of the bladder in its state of complete extroversion.

Laboratory examinations: December 25. Urinalysis: Catheter specimen from left ureter. Lemon color, hazy with shreds, slight acid,

1012, albumin plus, sugar negative acetone negative, diacetic acid negative. Sediment: Many pus cells, few red blood cells, few bacteria, few flat cells.

December 27. The bladder becomes again thoroughly extroverted and the large right and normal left ureters by direct visualization are catheterized. No kidney products are obtained from the right, heavy particles plugging the eye. Urinalysis from the catheterized left ureter: straw, clear with shreds, acid, specific gravity not sufficient quantity, albumin trace, sugar negative, acetone negative, diacetic acid negative. Sediment: Few caudate shaped cells, occasional flat cell, many pus cells.

December 29. The Pezzar catheter is retained sufficiently long to give for two hours a phenolsulphonephthalein test of 80 per cent.

December 31. Culture of bladder specimen. Specimen unsterile (?). Direct smear shows numerous gram positive diplococci, gram positive and gram negative bacilli, no one type predominating. No tubercle bacilli found. Culture: Heavy growth of various organisms seen in direct smear. No particular type predominates.

December 30. Quite a large membrane from the bladder is voided with the urine and on investigation Dr. Moon reports: "Specimen consists of fibrin thickly infiltrated with white blood cells. No true tissue present."

January 2, 1925. The bladder has not come down for three days, the Pezzar catheter is making the child very comfortable and the temperature is now running between 99 and 101. So far we have determined the following:

1. A large bladder, thickened, hypertrophied, crisp from repeated hyperengorgements of forcible eversion.

2. A large right pyoureter (associated most likely with an ureterocele which we could not locate).

3. A rudimentary or non-functioning right kidney whose retention products with that of its ureter were giving rise to severe hyperpyrexia and prostration.

4. A satisfactory left kidney whose 80 per cent phthalein return justified surgical attack on the right side.

The little patient was prepared by forced water intake and daily enema for operation. General anesthetic, chloroform. The incision was made in the anterior abdominal wall just internal to the anterior superior spine of the right side for about four inches, and an intramuscular operation on the ureter was attempted, our intention having

been to tie off this large ureter at the base of the bladder and bring it out at the lower angle of the wound thus establishing a temporary ureterostomy, later on to carry out a nephrectomy, but finally these muscles were cut at right angles so as to gain a better access. On reflecting the peritoneum anteriorly, a large, whitish ballooned structure was seen which was taken to be the intestine, probably the ascending colon. The finger was thrust well upward and felt the lower

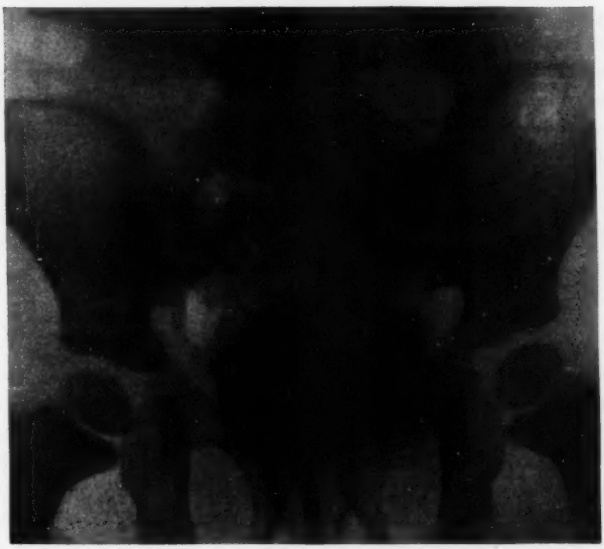

FIG. 3. INSERTION UNINTENTIONALLY OF THE CATHETER INTO THE ENLARGED RIGHT URETER FOR CYSTOGRAM IN WHICH THE STAINING SHOWED A LARGE MEGALOURETER

pole of the right kidney, which was quite movable, and on getting this organ more liberated it was found to be very long and narrow, extending well up under the liver. It was now noted that the structure above referred to as the intestine was the ureter, and closely adhered and parallel to it, throughout its course, was a second ureter so that the two lie side by side, each being about the same caliber and the size of one's finger. They were flattened, and whitish, the inner one tortuous and larger. They were liberated from the peritoneum to

low down in the pelvis, the kidney was now freed with some difficulty, brought down into the wound, its small pedicle clamped with forceps, tied firmly with two strands of chromic catgut No. 2 and severed. The ureters were now traced on toward the bladder, they ran close together but did not unite. One, which we designate as ureter No. 1, was implanted quite high in the posterior wall of the bladder, the other which we designate as ureter No. 2, the more internal one, the more redundant and larger of the two, skirted under the bladder to be lost in these tissues more anteriorly. This ureter, we feel assured, ends at the large slit-like opening near the normal left ureter. The operation having been longer than we had anticipated, both of the ureters were clamped close to the point of entrance of the upper, No. 1 into the bladder, they were severed, and the stumps were tied "enmasse" with chromic twenty-day No. 2. The tissues were brought together in layers with catgut No. 2, a sliver of tubing being put down to the kidney bed and brought out at the lower angle of the wound, interrupted silk-worm gut through the skin. The little patient made an excellent post-operative recovery and left the hospital January 17, 1925, temperature normal and she has apparently gained daily in weight and is no longer fretful and crying, there is no dysuria, the abdominal wound has healed and the urinalysis is practically negative.

January 20, 1925. She returns to the hospital and a cystoscopic examination is made. Takes the No. 24 French cystoscope easily while being catheterized the bladder mucosa begins to appear at the urethral outlet and give every evidence of a recurrent extroversion. This was shoved back, the hips elevated, the bladder filled with fluid and the cystoscopy continued and a rounded symmetrical tumor, the size of a small hazel nut was seen apparently swinging from the right floor of the bladder just behind the illy defined trigone; its base could not be seen, the mucosa of this mass was redder and more congested than the pinkish salmon colored mucosa of the remainder of the bladder, its margins were sharp, well defined and clear. The left ureteral os was seen in its normal position, its crater was somewhat reddened and moderately enlarged, larger than we have seen it before, it is not catheterized. The little finger being lubricated was inserted through the urethra and felt around in the bladder. No unevenness, tumor or irregularity could be located, the bladder having collapsed on the escape of its retained fluid when removing the instrument. The appearance of the vesical mucosa on this cystoscopy was much more approximating the normal than we had ever seen on any of the former

occasions, none of the petechial spots could be seen, there was no longer the general, intense congestion bordering on a mucosal blueness, nor was there the desquamative violet evidences of a traumatic cystitis, the mucosa throughout being a healthy, normal color. There were a few strutting vessels, but the brawny thick congestion had been replaced by a general elasticity and normality. The urethra had not contracted as we had confidently expected, its patency and relaxation was nearly as great as on former examinations. This "floating cone" is the evident cause of the urethral separation and violent extrusion for which we had long sought cystoscopically and otherwise, and never found.

A review of our errors and failure in an earlier diagnosis is interesting. Our first attempted catheterization of the bladder for x-ray resulted in inserting the catheter into the large slit-like opening leading to the upper right kidney, the resulting ureterogram we considered satisfactory, but the pyelogram incomplete as only the lower part of the pelvis showed. We appreciated only after nephrectomy that the pyelogram represented very accurately the extremely small pelvis and that its outline was in actual keeping with the pathological specimen. We likewise did not understand the very remarkable shape and location of the bladder, which apparently was directly confluent with this right ureter, to substantiate this a second x-ray resulted in an excellent cystogram on which occasion the staining fluid was actually put in the bladder and not directly into the ureter. This x-ray was in marked contrast to the first supposed bladder stain. That there was no regurgitation up this enormous ureter as had occurred in the first cystogram was inexplicable. This anomalous return provoked the second cystoscopy in which we inserted the No. 24 French instrument, by chance, likewise into the large ureter and were consequently unable to locate the ora, the usual vesical landmarks, or catheterize the ureters. Our failure to accomplish anything whatever by this cystoscopy was satisfactorily explained to ourselves, when we recalled the intense congestion and disarrangement of the normal state by the repeated traumata of a pathologic exstrophy. It was only when there had been a complete extroversion and the ureteral ora seen and

directly catheterized that we realized what had formerly occurred. For we had considered the possibility of the tumor being a complete exvagination of the large ureter, No. 2, through the urethral channel. We had on our first attempt, catheterized and cysto-

FIG. 4. EXAMINATION FOR PYELGRAM REPEATED IN WHICH AGAIN THE CATHETER WAS INSERTED DIRECTLY INTO THE URETER

Note the discrete caps which we could not at this time explain

scoped the right ureter, No. 2, only, and our subsequent catheterization and cystoscopic investigation had to do with the bladder only. Such anomalous returns were most confusing. That we did not obtain an ureterogram on filling the bladder was now

explained by the pressure of either the cystoscope or the bladder medium so holding down the ureteral valve that there could be no regurgitation. The escape of purulent urine from the upper marginal surface of the inverted bladder, which we had seen occur in spurts and jets on several occasions, was readily explained as the contents of the upper ureteral implantation, ureter No. 1, and not urinary products caught in the folds of an inverted bladder.

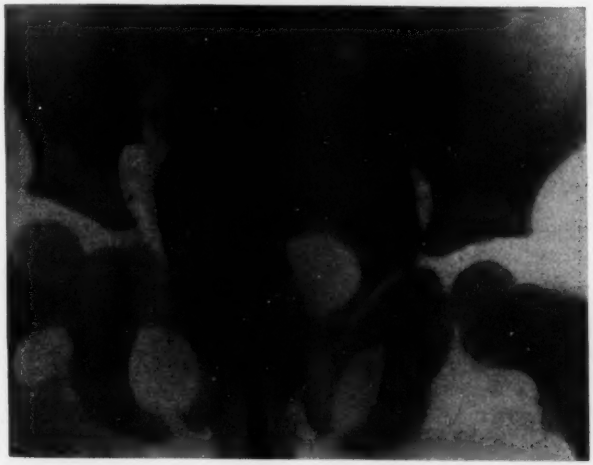

FIG. 5. INSERTION OF THE CATHETER DIRECTLY INTO THE BLADDER WITH A SATISFACTORY CYSTOGRAM

January 22. Renal efficiency test 65 per cent.

Dr. Moon's pathological report on the double right kidney is as follow:

"All the normal structure parts of cortex and medulla are present. Many round cells are present, infiltrating and in clusters, and an evident severe suppurative pyelonephritis, with manifest destructive effects on the epithelium and some hyalin degeneration, especially in the malphighian tufts."

February 28. Returns for cystoscopic examination, chloroform anesthesia. There is no evidence of inflammation about the urethra. The mother states the child has gained considerably in weight, voids

normally and naturally, with no effort or pain, has no temperature, is bright and happy, sleeps well and has never had a recurrence of the eversion. The wound has thoroughly healed and there is no weakness of the abdominal muscles. It was decided to use the No. 24 French cystoscope, which was admitted with ease into the bladder, and it was noted that the sphincter muscle was not as atonic and relaxed as on former investigations, the cystoscope fitting more snugly, the mucosa being of the normal pinkish salmon color. The left ure-

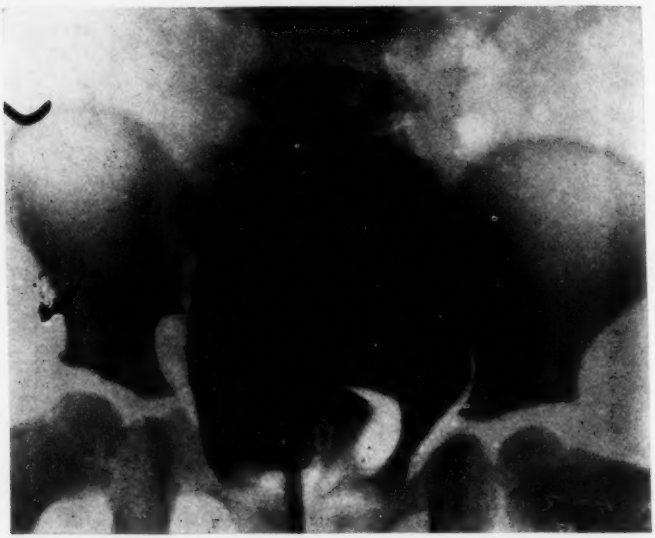

FIG. 6. INSERTION OF CATHETER INTO BLADDER WITH MORE SATISFACTORY CYSTOGRAM

teral os was immediately located and the small "waving cone" which had been described in our cystoscopic examination of January 22 is still seen to the right, its outline clear and distinct, the free borde, of the mucosa transparent, but it is not as large as on the former examination, it is shorter, more rounded, flattened and does not project so far into the cavity of the bladder and is about the size of a large pea. We believe this structure, this so called "floating cone" to be distinctly an ureterocele, but one that points off to the right rather than towards the neck of the bladder, and that it represents the

vesical dilated end of ureter No. 2, and we furthermore feel reasonably assured that, its accumulating contents having been reduced by nephrectomy, it will ultimately atrophy and disappear. It would seem that during the act of extroversion that the contents of the ureters were milked backward towards the kidney, the bladder and ureters fitting so tightly in the urethra that there could be no ureteral flow downwards thus producing the ureterocele when the bladder was outside the body. Repeated examinations of the everted bladder did not indicate any localized mural weakness about this os, the congestion and edema being so great that normal conditions were thoroughly misrepresented, for one is not altogether accustomed to seeing the bladder upside down and the trigone in just the reversed position of its normal habitat.

Blood report: Hemoglobin, 80 per cent; red blood cells, 4,200,000; white blood cells, 7000.

Urinalysis: Clear, acid, 1020, no albumin, no sugar. Few epithelia, some leucocytes, 4 to 6 to the high power field.

DISCUSSION OF CASE

Hernia of the bladder through the urethra is rare. In the infant it is most exceptional. Pousson has devoted much time to the consideration of this condition and reports 21 cases altogether having analyzed all of them thoroughly and given a complete bibliography. His classification of the degrees of extroversion appear most acceptable: (1) Hernia of the vesical mucous membrane through the urethra, all of which occurred in women, and (2) inversion of all the walls of the bladder which may be (*a*) incomplete, (*b*) complete.

Incomplete inversion is an invagination of the bladder at the outlet, and, in the cavity thus produced, the uterus and the intestines can become lodged as in a receptable; three cases have been encountered of this form, two in men and one in a woman.

Complete inversion or hernia of the bladder through the urethra, (urethral cystocele, cystoptosis) is the most frequent form, because, according to Pousson, out of 21 cases, 15 were of this type and occurred only in women. According to Gross the complete inversion is much rarer, he states that only 7 well-authenticated cases are on record. Five of these occurred in female chil-

dren from fourteen months to four years of age. Of the remaining 2 cases, one was in a fat woman, aged fifty-two years, who was subject to chronic bronchitis, the other in a woman, forty-two years old, and appeared to be due to acute cystitis with constant straining, set up by the presence of a patch of phosphatic deposit on the wall of the bladder. Pousson says that entire eversion of the bladder without prolapse of the rectum or uterus is very rare and has occurred only in Meckel's case. But when prolapse of the bladder is complicated also by prolapse of the uterus, rectum or vagina, then hernia of the bladder can also be complete. According to Albert, prolapse of the bladder is complete in the majority of cases; he reports a case of complete extroversion unassociated with prolapse of the other organs. Pousson also states that more often it is one part only of the bladder which becomes herniated, so that the trigone remains in place and the remainder of the bladder holds urine.

Among the 21 cases Pousson reports, the patient's ages are mentioned in 14, only 2 were in early infancy: one, a female child of nine months and the other, a female child of sixteen months, both cases of hernia of all the bladder walls.

Imerwol's case, reported since Pousson's statistics, then would be the third one of early infancy, but this case had an associated rectal prolapse 10 cm. in length.

Leedham-Greene says that many varieties of the condition are met with, from the (1) mere *dimpling* in of a portion of the bladder wall without any prolapse of the organ, as described by Foubert and by Rutti, to the (2) complete inversion and prolapse of all the walls of the entire bladder, as in the cases mentioned by de Haen, Malagodi and Meckel. In the majority of cases recorded, urine can still collect in the unaffected portion, though its expulsion may be prevented or hindered by the inverted part blocking the urethra. Malagodi also relates a case associated with rectal and uterine prolapse. Meckel reports a case of complete inversion and prolapse, the only one on record up to the present report, without displacement of the other pelvic organs. All these cases are found in females in whom prolapse of the inverted organ is alone possible. Yet there are a few instances in which the first

stages of a slight inversion of the male bladder have been noted. Gross refers to a case published by Bamberger, of prolapse of the mucous membrane of the bladder into the upper dilated urethra

FIG. 7. DIRECT CATHERIZATION OF THE URETERS WITHOUT MEANS OF CYSTOSCOPE WHEN BLADDER WAS OUTSIDE OF VULVA, LEFT CATHETER REACHING WELL UP, RIGHT CATHETER ARRESTED AT THE PELVIC BRIM

in a male. Foubert describes the history of an old officer who for some years before his death had suffered from retention of urine which had to be relieved by the catheter. After death it was found that the bladder was pouched at its upper and posterior

part, the point of invagination reaching to the neck of the bladder. Rutti also mentions a similar case in a man where the cecum occupied the pouch formed by the invagination of the bladder. Noel, Patron, Malherbe, Pousson, and others also record instances of a prolapse affecting the mucous membrane of the bladder only. Verdier attributes the cause of incomplete inversion of the bladder, in the case of a prostatic patient, to the relaxation of the bladder walls, which had been long distended by accumulated urine.

ETIOLOGY

Pousson believes that when the vesical mucous membrane is alone prolapsed, it is brought about in the first place, by a dilatation of a pre-existing mucous crypt at the neck of the bladder, which pushes the urethral mucous membrane before it until it appears at the urethral orifice. He bases this view on microscopic observation of the extirpated prolapse in cases met with by Malherbe and himself.

Prolapse of the bladder through the urethra, without any previous rupture, occurs only in women because their urethra is short and easily enlarged. The prolapse can occur only when there is great relaxation of the bladder and an unusual elasticity of the urachus. Gross says: "The probability is, that a congenitally relaxed and weakened condition of the muscular fibers of the neck of the bladder and urethra is the essential cause of the trouble, and that inversion of the bladder takes place during fits of crying, coughing, sneezing, or straining. In all cases, the urethra must be greatly dilated. . . . ." Leedham-Greene states that frequently there is the history of a fall, or other injury from which the patient dated the onset of the trouble. A history of straining, such as that caused by prolonged diarrhea or vesical tenesmus, is noted by others. Thompson, for instance, mentions the case of a woman, aged forty, who, during an attack of acute cystitis, suddenly experienced a violent pain on micturation. On examination he found a firm tumor, about the size of a walnut, projecting from the orifice of the urethra. Under an anesthetic the finger could be passed into the bladder by the side

FIG. 8. STAINING OF RIGHT KIDNEY AND URETER WITH 25 PER CENT SOLUTION OF SODIUM BROMIDE, ILLUSTRATING THE DEFORMED PELVIS AND MEGALOURETER

of the tumor, and its pedicle felt to be springing from the posterior wall of the bladder. There was an incrustation which was

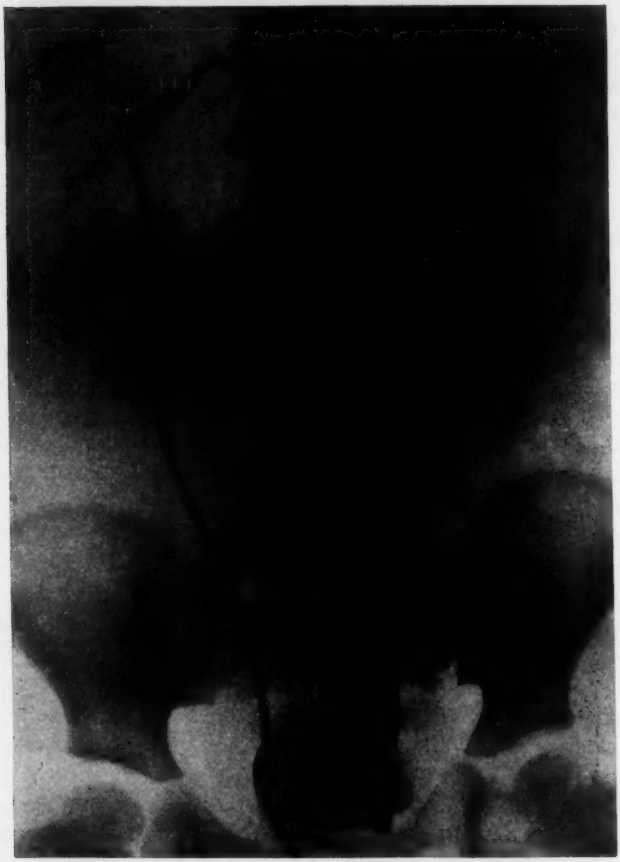

FIG. 9. ILLUSTRATES THE DEFORMED PELVIS, KINKED AND ENLARGED URETER, APPARENTLY WELL DEFINED URETEROCELE AND ABNORMAL SEPARATION OF SYMPHYSIS

removed and the prolapse reduced. After the reposition, the wall of the bladder could be felt by the finger to be quite normal.

There was no return of the prolapse, and Thompson regarded the case as an invagination brought about by the natural straining of the bladder to get rid of the incrustation, whose weight had led to the first dimpling of the bladder wall. Puech and Fr. Puiy Ametler have observed a prolapse of the urethra in a girl of six years, the cause of which they attribute to vulvitis and blenorrhagic urethritis from which she had suffered since the age of four.

Rectal prolapse has been associated with several cases of vesical extrusion, the attending tenesmus and diarrhea unquestionably provoking the hernia of the bladder. Associated conditions must be coexistent, however, such as a spacious bladder, relaxed walls and a preternatural separation of the symphysis pubis which condition your writer does not believe has been sufficiently stressed. Lockhardt-Mummery found in 50 cases of measles, 3 with prolapse of the rectum. Imerwol's case contracted measles a month and a half before the inversion of the bladder occurred. Our case had measles six months before the first bladder onset.

Determining causes are the perineal relaxations and atonic state of the multipara such as anteflexion, anteversion and especially prolapse of the uterus and rectum, which have been observed many times in cases of hernia of the bladder. Pousson calls attention to *diarrhea* and *dysentery* which increases abdominal pressure; Perry states that *obesity* causes a relaxation of the tissues and diminution of the abdominal cavity; Thompson emphasizes spasms of the bladder, caused by a deposit of phosphates with cystitis, a fall, and violent attacks of coughing.

Aside from all these causes, the bladder must be wide and its walls relaxed, so that the intestines by their continued action will be able to depress, invaginate and invert it (Verdier, Chopart, Boyer, Streubel, Albert) for, in the normal condition, the bladder, filled with urine, holds up the abdominal organs.

DIAGNOSIS

Wilkinson says the most important signs are the presence of a pyriform, red, vascular, soft, elastic, reducible tumor, about the size of a walnut, situated below the clitoris and between the labia,

which may become injected and increased in size on crying or straining. There is usually more or less dysuria or incontinence both before and after its appearance. The orifice of the ureters may be exposed or rendered visible by gentle traction on the protrusion. The diagnosis of bladder prolapse may be very simple, as in the case that came under the notice of Leedham-Greene, where the detection of the openings of the ureters at once revealed

FIG. 10 FIG. 11

FIG. 10. ANTERIOR VIEW OF THE REMOVED KIDNEY AND DOUBLE URETER
FIG. 11. POSTERIOR VIEW OF THE REMOVED KIDNEY AND DOUBLE URETER

the true nature of the condition. Or, when the prolapse is less complete, it may easily be mistaken for a simple prolapse of the urethral mucous membrane or the extrusion of a pedunculated bladder tumor; as in the case recorded by Crosse, where a surgeon was about to ligate the supposed tumor. But perhaps the most difficult case to diagnose is that in which there is a prolase of a dilated cystic condition of the lower end of the ureter, such as

Englisch, Cohn, Fenwick and others describe. But here the translucency of the cyst is characteristic, and a cystoscopic examination, made after returning the prolapse into the bladder, should at once clear up the diagnosis.

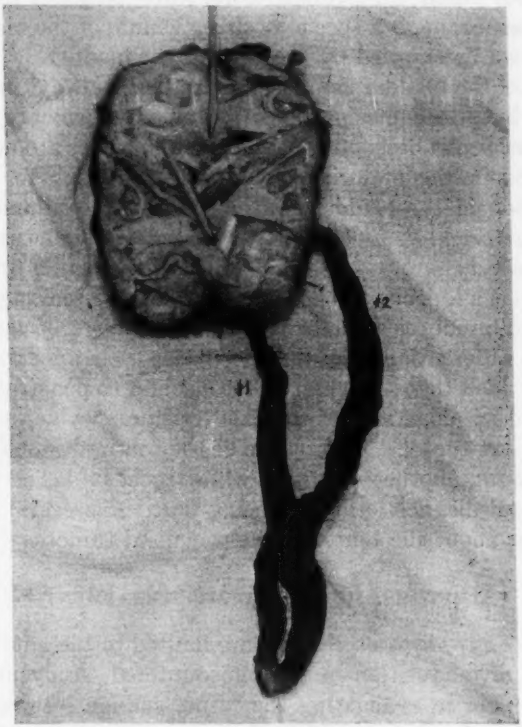

FIG. 12. VIEW OF THE DOUBLE PELVES, SOME OF THE LINING MEMBRANE HAVING BEEN REMOVED FOR PATHOLOGICAL INVESTIGATION

DIFFERENTIAL DIAGNOSIS

Prolapse of the vesical mucous membrane, is the most difficult condition from which to diagnose complete extroversion. This consists solely of mucous membrane which has become separated from the bladder muscular wall and forms a soft tumor, half-

transparent, has a thin wall and possesses a slender pedicle. Patron recommends puncture of this tumor, which, in case of prolapse of the mucous membrane should give urine; and in case of prolapse of all the bladder walls, remains as formerly or discharges a peritoneal liquid; and, furthermore, since hernia of the vesical mucous membrane, is a species of diverticulum of the bladder, its contents can be emptied by pressure on the bladder.

Hernia of the bladder through the urethra is always possible to diagnose, but it becomes particularly difficult when only a part of the bladder protrudes, so that the ureteral orifices are not visible (as obtains in the majority of cases). According to Pousson, exvagination of the bladder can be justifiably confounded only with (1) *a tumor of the bladder*, prolapsed through the urethra (which is a very rare condition in children) and is of a firmer consistency, has a longer pedicle, cannot be compressed and reduced easily, and produces hematuria, and (2) *tumors of the urethra* which are differentiated by their location, their appearance and their color, and that it is possible for a sound to penetrate deeply in the bladder along side of the urethral tumor which could not happen in exstrophy. In prolapse of the urethral mucous membrane is found another condition which must be borne in mind, the principal diagnostic feature being that the urethral orifice is found in or about the center of the prolapsed tumor.

SYMPTOMS, MORTALITY AND TREATMENT

Subjective symptoms necessarily are limited to the adult, all the anomalies of micturition may be encountered, as dysuria, difficulty and pain in evacuating the urine, sudden interruption of micturition, urination possibly only in a certain sitting or standing position, or only with the bladder reduced and fixed in position with an instrument such as a sound, and the varying degrees of hemorrhage associated with the presence of a tumor.

Mortality. Pousson observed 17 cases to the end, and states that in 6, death occurred from vesical gangrene and urinary infection.

In small children the prognosis is apparently more favorable:

the nine-month-old baby of Weinlechner recovered as did Imerwol's two-year-old and our two-and-one-half-year-old patients.

Treatment consists in reposition and prevention of further prolapse. The prolapse can usually be reduced much the same as a

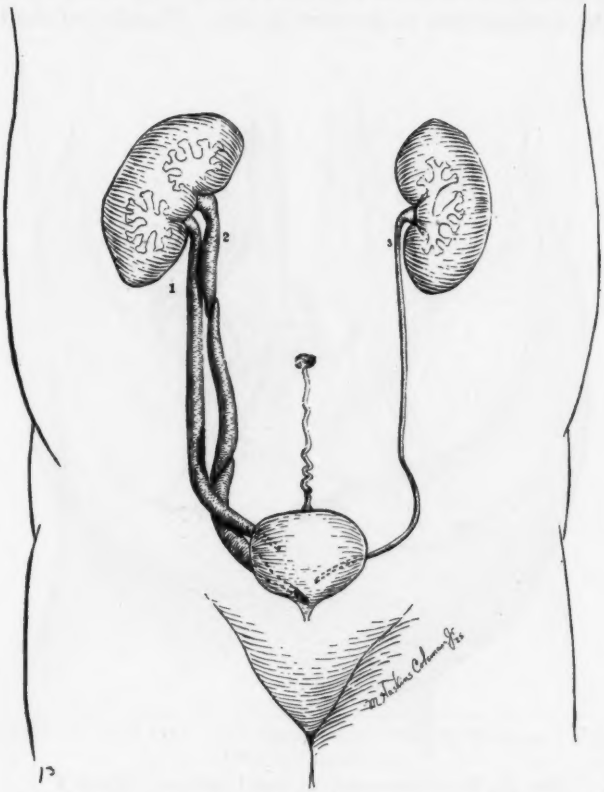

FIG. 13. OUR SCHEMATIC PRESENTATION OF THE CONDITION

rupture. It is much more difficult to prevent a recurrence especially if the prolapse is of long standing. Sometimes mechanical assistance such as is used in prolapse of the vagina and uterus may be used. One should first try external pressure and narrow-

ing of the pelvic circle by a bandage or adhesive incorporating the pelvis in the form of a figure eight. The dorsal-decubitus position in Imerwol's case was prolonged for two weeks after the first, and again three weeks after the second reduction of the bladder; in any case, it is better to maintain this position long enough to give the urethra time to decrease in size. Fixation of the thighs

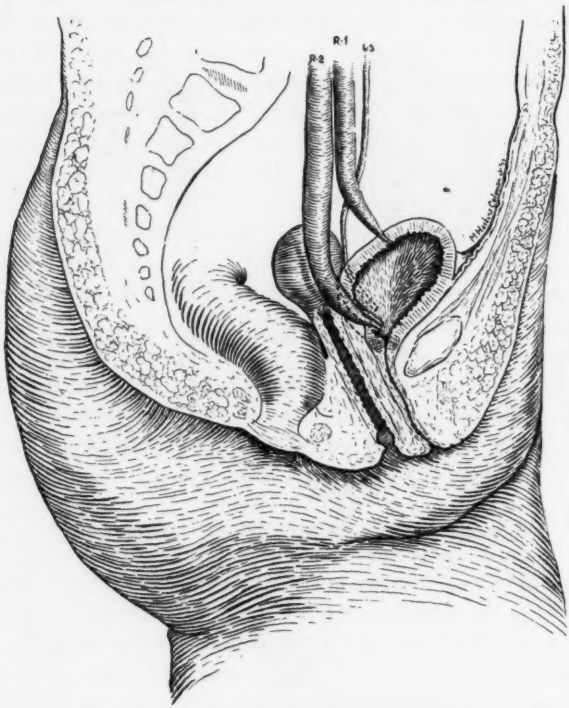

FIG. 14. THE INSERTIONS OF THE URETERS 1, 2 AND 3

is an indispensable addition to success in small children. As a last resort one can introduce a small rubber bag like a colpeurynter into the bladder, or, as we had the occasion to use, a suitable Pezzar catheter. Leedham-Greene and Weinlechner's cases were reduced under anesthesia, and a bandage applied to prevent

further extrusion, this proved sufficient in these instances to effect a cure. Lowes' case was more difficult, inducing him to adopt the bold procedure of repeated cauterization of the urethra. Where the prolapse affects the mucous membrane only, then its excision, as practiced by Patron, Malherbe and Pousson, prob-

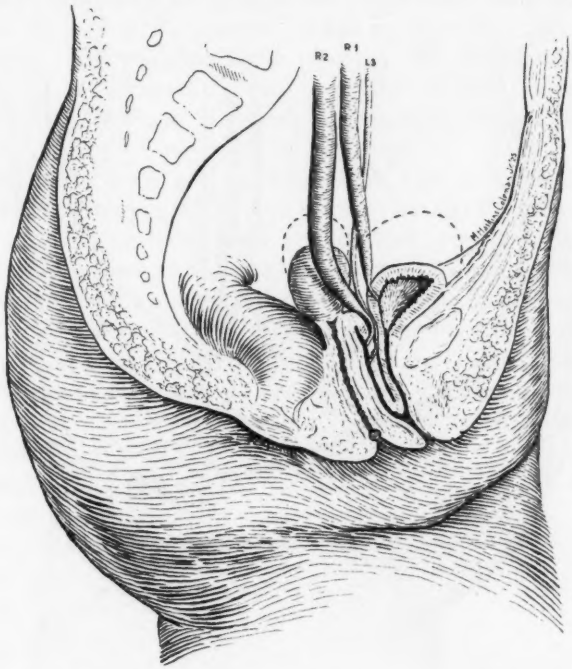

FIG. 15. TO ILLUSTRATE THE MILKING BACKWARD OF THE CONTENTS OF THE URETER SO THAT AN URETEROCELE COULD NOT BE EVIDENT DURING ACTUAL EXASTROPHY

ably offers the best method of dealing with it. It has been suggested that the complete herniations should be excised also, even though the condition involves all the coats of the bladder. This method of treatment cannot be recommended when the ureters are found in the displacement.

In a case (observed by Crosse) in a three-year-girl, the

surgeon was about to remove the tumor when Crosse discovered the mouth of one of the ureters. The bladder was replaced by pressure, but this was followed by a slight incontinence. At first it was hoped that, if the prolapse were reduced and prevented from coming down for a few weeks, the urethral sphincter muscles

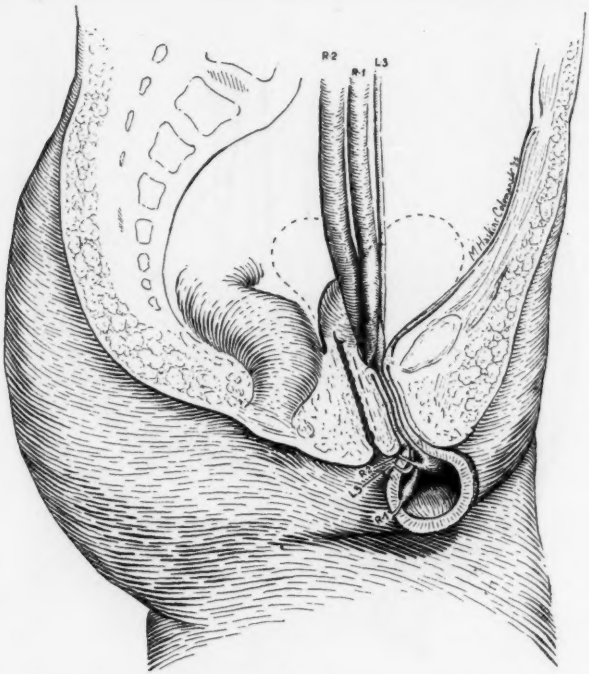

FIG. 16. COMPLETE PROLAPSE OF THE BLADDER WITH THE LOCATION OF THE URETERS BEING WELL SHOWN

would regain their tone, and the tendenccy to prolapse would disappear. The buttocks and thighs, therefore, were simply strapped and the urine drawn off with a catheter from time to time. As this method failed to retain the extroversion, the vagina was packed with iodoform gauze, to compress the urethra slightly against the symphysis. The buttocks and thighs were fixed

together and the child was suspended by the legs in a gallows splint, as in the treatment of fracture of the thighs in infants. This treatment was more successful, but failed to cure, there being a tendency to recur when the child cried or strained, so that this method was abandoned. Finally under an anesthetic a small amount of *liquified hard paraffin was injected into the periurethral tissue at the neck of the bladder.* This measure at once proved successful. The prolapse never recurred, the cystitis which was present rapidly cleared up, and the child when last seen, some four months after the injection, had perfect control over the bladder.

In adults to maintain the bladder in situ is more difficult. Solligen and Percy cured a case by the placing of a sound introduced into the bladder, fixed outside and worn permanently. Levret, in two cases of hernia of the bladder, evidently caused by marked anteversion of the uterus associated with vesical invagination, supported the uterus with a pessary and had good results.

Radical surgical treatment must be chosen for each individual case, Pousson recommending cystopexy for incomplete inversion, exsection for complete exstrophy. It has likewise occurred to us that freeing the urethra and revolving it about its axis for one-half turn or more may offer a satisfactory solution in selected instances.

REPORT OF INTERESTING CASE OF EXTROPHIC BLADDER WITH NEOPLASTIC IMPLANT

By JOSEPH F. McCARTHY and PAUL KLEMPERER

Departments of Urology and Pathology, New York Post Graduate Medical School and Hospital

Received for publication June 15, 1925

CASE HISTORY

Patient, I. S., aged forty-seven, native of Russia. Occupation, tailor. Resident of United States sixteen years. Born with extrophic bladder. Subsequently subjected to nine operations of the cutaneo-plastic type, in Vienna and Petrograd. While in Vienna he came under the observation of Zuckerkandel. A moderate measure of success was achieved in the construction of a roof over this exposed bladder, but complete success never accomplished because of the fact that sinuses were almost always present through which oozed pus and urine. The patient, as might be expected, for the greater part of his life had a low grade purulent cystitis. In the mechanism of urination the stump of the organ was angulated and held in position by means of a mechanical appliance. When he wished to void, this was released and pressure of the hand on the bladder relieved it of the bulk of its contents, though it never completely emptied.

He came under the observation of the writer about fourteen or fifteen years ago and since this time has been treated symptomatically and used as a show case. Toward the latter end of this period he gave evidence of intermittent attacks of pyelitis and pyelonephritis, ushered in by chill, pronounced rise in temperature, marked prostration. Subsidence following rest in bed, diluents, urotropin, diet restriction, etc., in a few days he apparently would be all right again.

He followed his occupation as a tailor and some years ago took unto himself a wife, the mutual desire being companionship. In passing it might be stated that no more devoted couple have come under the reader's observation.

About three years ago he returned giving a history of two previous attacks of hematuria. Examination readily disclosed the presence of a fungating growth emerging through one of the sinus openings. Diathermy was suggested and employed. The bladder was opened, thoroughly exposed, a very extensive growth of cauliflower type with marked excess of mucoid material. Observed, and treated by means of intensive diathermy. No attention was paid to either ureteral orifice as the case demanded radical measures, occlusion, if it did take place, would in all probability be temporary. The convalescence was uneventful. An attempt at partial closure of the bladder failed, the whole incision subsequently breaking down. It was then deemed advisable to maintain the bladder as an open organ so that repeated diathermy might be the more conveniently employed. The writer felt that here was a case if ever, where ideal conditions prevailed and where one might reasonably anticipate a prospect of cure or relative permanency of removal under this procedure. The patient had a moderate recurrence in about six months which was again diathermized, but a year later his recurrence was much more pronounced and apparently of somewhat different physical characteristics. To the sense of touch there was a pronounced induration, not noticeable in the early stage. Most of the men in our department felt there was but one recourse, total cystectomy. The patient demurred, naturally, at this. In fact we hoped he would continue demurring. Our hopes were groundless as he returned with the request that his bladder be removed. The procedure was thoroughly explained to him. He, an intelligent individual, fully concurred.

As a preliminary operative measure bilateral ureterostomy of the anterior abdominal type was elected, but owing to the size of the ureter and the difficulty encountered on the left side, it was deemed advisable to defer the other until a later date. The ureter on the side ureterostomized readily carried a No. 30 F. tube. This operation was performed under general anesthesia. During convalescence from the ureterostomy it was noted that little or no urine came through the bladder, nothing but pus being seen. Indigo-carmine administered, time of dye appearance on the right (ureterostomized) side was prompt and the flow was good, none appearing in the bladder. This test was repeated. It was then suggested to the patient that his kidney on the other side was of little use, that nothing could be gained from ureterostomy, though he desired to take a chance. Finally, nephrec-

FIG. 1. A PHOTOGRAPH TAKEN WHEN PATIENT FIRST CAME UNDER OUR OBSERVATION

From reader's left to right is to be noted the stump of the organ—the cutaneoplastic bladder roof—and the pronounced left inguinal hernia. At the bottom of the new formed bladder several punctate openings may be seen.

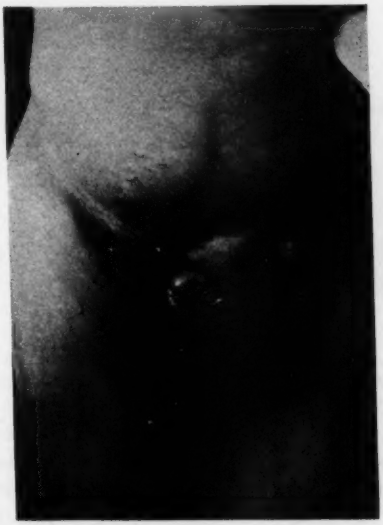

FIG. 2. VISUALIZES THE PRONOUNCED HERNIATION OF THE CAULIFLOWER GROWTH

tomy was consented to. The patient insisted upon the employment of local anesthesia, as he had observed the effect of this anesthesia on other cases in the ward. Nephrectomy was then performed under para-vertebral and field block anesthesia. His convalescence here

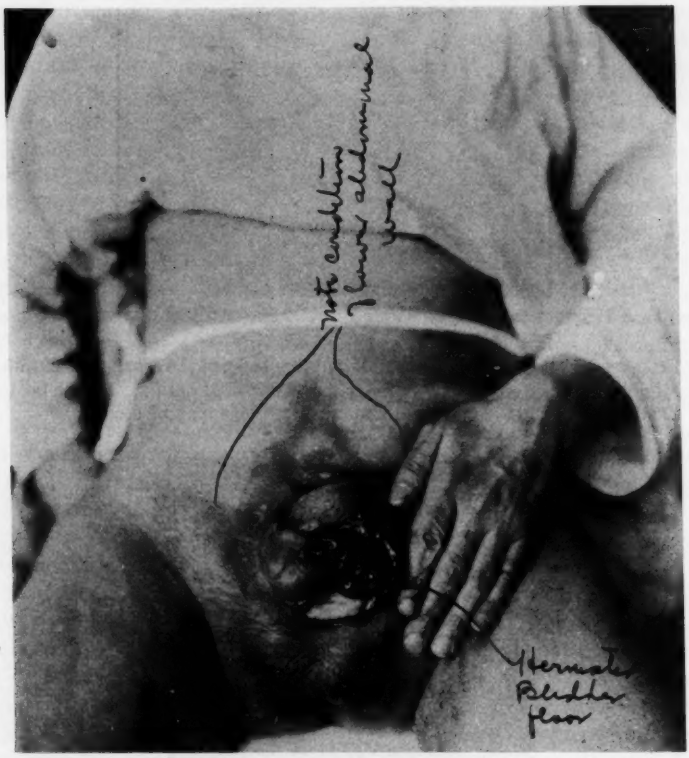

FIG. 3. THE HERNIATED BLADDER FLOOR SOME WEEKS AFTER DIATHERMY

It also shows the cicatrization of the lower abdominal wall incident to the numerous plastic operations and the repeated exposures to deep x-ray therapy.

was uneventful whereas his previous convalescence under general anesthesia had been somewhat stormy for a few days. The ureter on this, the nephrectomized side, was exceedingly large, dense thick-walled. Possibly a complete ureterectomy might have been done, but the patient's condition would not have tolerated it. After a few

weeks we believed his condition warranted the final operation of complete cystectomy. This was also done under sacral and field block anesthesia, also by special request. An entirely extra-peritoneal procedure as at no point was the peritoneum entered. Convalescence was likewise without incident save for some breaking down of the

FIG. 4. A LATERAL VIEW OF KIDNEY SCAR AND APPARATUS

incision which is about healed by granulation at the time of report of this case. Since the final operation the patient has completely lost the septic look noted prior thereto, the color is coming back in his cheeks, he is in a condition of infinitely greater comfort than he has ever before experienced and has, the reader believes, a fair prosect of the fulfillment of his original request of viability to the age of fifty, and the continuation of his job as a show case for us.

OBSERVATIONS AND CONCLUSIONS

Here is a patient who has had cystitis practically all his life. Blood pressure findings are within normal range; blood chemistry

FIG. 5. FRONT VIEW URETEROSTOMY SCAR AND APPARATUS

findings are normal, his case adding another link to the chain of evidence indicating the importance of obstruction as a factor in surgical uremias rather than the mere presence of infection.

Our election of the left side in the first step of the ureterostomy was a matter of luck, inasmuch as had we elected the opposite side we would have brought out a ureter of a pyelonephrotic kidney; as it was we happened on the ureter of the only good kid-

FIG. 6. A WELL NOURISHED INDIVIDUAL WHO, SINCE THE WRITING OF THIS ARTICLE HAS BECOME OUR MOST EFFICIENT NIGHT ORDERLY

ney in his possession at the moment. Once the bladder had been opened and the growth destroyed, indigo-carmine tests should have been done as a routine. We would then have been pre-informed as to the relative status of the two kidneys.

Finally, from the technical standpoint, we had to deal with an abdomen with a pronounced left sided direct and indirect hernia, a belly wall upon which eight or nine operations of the cutaneoplastic type had been done and repeatedly exposed to intensive x-ray therapy. Instead of muscular structures nothing but scar tissue remained (at least in the operative zone). A routine incision and exposure under such conditions, would doubtless have resulted in failure. Our technical procedure then was to circularize the bladder, to skelatinize the same from below as has been previously advocated by the reader. The ureter of the left, the ureterostomized side, was first identified, clamped and cut; the vesical neck then mobilized, clamped and cut, which finally brought us to the large, dense, fibrous ureter of the right or nephrectomized side, which was similarly treated. By traction on the bladder from below upwards, aided by blunt and sharp dissection, the organ was separated from its hypogastric and urachal attachments and delivered.

Histological examination of the tumors removed December, 1922, and May, 1924, revealed the same picture of an adenomatous neoplasm which closely resembled the adenomas of the large intestine. It was formed throughout by larger and smaller gland-like structures which were lined by high columnar epithelial cells; among these, numerous goblet cells. Notwithstanding the surprising general structure the tumor did not exhibit definite histological features of a very malignant neoplasm. However, a specimen removed in August, 1924, revealed very marked changes. The glandular structures were still present but they did not form the bulk of the tumor. In their place islands and nests of polygonal cells with mucoid degeneration were found infiltrating the stroma at large. These cells frequently presented the type of signet-ring cells. The histological examination of the extirpated bladder showed, in several places, glands as well as the signet-ring forms. The latter were found to infiltrate deeply into the wall of the bladder. The histological picture was similar to that of an anaplastic adeno-carcinoma of the large intestine with mucoid degeneration of the tumor cells. To explain this unexpected picture we had to ascertain at first that the adeno-carcinoma of the extrophic bladder was not a metastasis

of an intestinal neoplasm. In the absence of any subjective and objective findings this possibliity could be discarded with certainty. The close relationship which exists between bladder and rectum during embryonal life suggested an explanation of the formal genesis of the tumor on the basis of an embryonal malformation. This hypothesis, however, though very suggestive, cannot be upheld in the light of the investigations of Enderlen, Juckerkande and Stoerck. The mucosa of the extrophic bladder quite commonly contains a great number of glands imitating intestinal crypts. But Enderlen could demonstrate that these glands only develop during post-natal life, due to continuous irritation, since the extrophic bladder of the new-born is lined with regular transitional epithelium. Juckerkande and Stoerck found the occurrence of glandular structures in the inflamed mucous membrane in chronic cystitis and have termed this condition glandular cystitis. They emphasize that the glands cannot be conceived as remnants of the cloacal epithelium but maintain that they are the result of metaplasia of the ordinary bladder epithelium produced by the chronic irritation. They could prove their point by the demonstration of glands in a vesical fistula which had developed after vesicotomy. Paschkis, a student of Juckerkande, in describing a case of an adenoma of the kidney pelvis clinched the statement of his teacher, by the demonstration of glands imitating intestinal structures, in a location where there is no relation with the cloaca. It seems to prove that the mucosa of the urinary tract is capable of far-reaching metaplasia. Among the 21 cases of carcinoma of the extrophic bladder, reported in the literature, 15 cases were adenocarcinomas with the characteristics of intestinal carcinoma, 4 squamous-cell carcinomas, and 2 without histological report.

We are reporting therefore, a patient in, so far as I am aware, the unique situation of carrying on very nicely with one kidney removed, the ureter of the remaining kidney ureterostomized abdominally, the bladder completely extirpated.

The reader finds himself unable to conclude without the expression of profound admiration for the sustaining confidence, the enduring fortitude and the unlimited moral and physical courage manifested by this patient.

CASES OF RETENTION OF URINE DUE TO POSTERIOR URETHRAL VALVE AND CYST OF PROSTATE

EDWARD L. KEYES

Received for publication June 15, 1925

I. POSTERIOR URETHRAL VALVE

W. L. (14671), eighteen years of age, consulted me on March 17, 1923, complaining of incontinence of urine. Urination had been slow since infancy. At the age of eight years this became so annoying that to relieve it he was circumcised under a general anesthetic. Since that operation nocturnal incontinence had been practically constant and he noted great difficulty in urination by day, though he could hold his water three or four hours.

Physical examination revealed a distended bladder filling the hypogastrium of a lean but well-developed young man.

The urine was passed in a dribble; contained pus and albumin.

Rectal examination revealed nothing abnormal.

Catheter drew 12 ounces of residual urine and seemed to be grasped a little in the posterior urethra.

The pupils were slightly unequal in size and reacted, I thought, slowly. The knee and ankle reflexes were somewhat exaggerated.

The patient was returned to his physician with instructions as to administration of hexamethylamine and the necessary diagnostic procedures to determine the presence of cerebro-spinal syphilis. He found the blood Wassermann negative, and the spinal fluid Wassermann negative; globulin negative; colloidal gold negative; and lymphocytes 4 cells to the cubic millimeter.

The patient returned to me on March 17, 1923, and I passed a No. 24 cystoscope into the bladder, meeting a definite resistance in the posterior urethra, and found the bladder mildly inflamed and trabeculated, but nothing else of significance.

The residual urine was again about 12 ounces.

I suggested an operative exploration of the bladder in the expectation of finding a contracted bladder neck which had not shown by cystoscopy.

The bladder was opened suprapubically June 26, 1923.

The urethral orifice was found somewhat dilated so that the finger-tip could be readily introduced into this, and met a marked obstruction at about the region of the verumontanum. A small sound was then passed through the urethra into the bladder and on withdrawing this, the finger following the point of the instrument could feel a small hole in what was evidently a congenital membrane obstructing the urethra almost completely at about the level of the veru. This membrane was grasped with Kocher forceps and drawn into the bladder neck. Its base was thus determined as being on the roof of the urethra. It was readily excised and subsequently found to be only a fold of mucous membrane.

The convalescence was uneventful and ten days later the patient was urethroscoped and an irregular ulcerated spot found, about 1 cm. in transverse length, on the roof of the prostatic urethra just over the veru. It was believed that this ulcerated spot represented the point from which the veil had been detached. No trace of obstruction now remained.

The patient left the hospital three weeks after operation, completely cured and emptying his bladder.

He reports by letter February 4, 1925, that he has been entirely well since the operation.

II. CYST OF PROSTATE

The following two cases were successfully treated by implantation of seeds of radium emanation.

Case 1. B. L. (16871), a Russian, thirty-nine years of age, consulted me March 24, 1923, complaining of acute complete retention, which had persisted for one week, during which time his urine had been regularly drawn by catheter. He gave no previous history of urinary disturbance or of venereal disease.

External physical examination was negative throughout. His eye, knee and ankle reactions were normal. The prostate felt normal by rectum. One of the seminal vesicles was slightly distended. The urine as drawn by catheter was slightly hazy with pus and bacteria and contained a faint trace of albumin. A renal function test was not done.

Cystoscopy showed a small "solid" tumor, projecting into the bladder from the upper part of the right lobe of the prostate. This

tumor was judged to be about 3 cm. in diameter and projected so much from the lobe at its base that it was deemed a neoplasm. Its surface seemed slightly inflamed, as was the rest of the bladder, but no irregularities or papillary projections were seen growing from it.

A diagnosis of carcinoma of the right lobe of the prostate was made and the patient was advised to return for the implantation by cystoscope of radium emanation seeds.

Two days later he reported for this treatment, but when I plunged the seed (0.5 m.c.) of emanation into what I supposed was a "solid" tumor, to my surprise it collapsed with the sudden clouding of the cystoscopic field by the milky prostatic fluid which had been contained in the cyst. The seed was left in the cavity of the cyst.

The puncture of the cyst immediately and completely relieved the retention of urine.

The patient reported again on May 14, 1923, six weeks after the operation. At that time he was entirely free from symptoms and refused cystoscopy.

Two years later, April 28, 1925, he reported himself entirely well, but the urethroscope showed a slight trogonitis (no residual urine) and a few granulations on the urethral roof, above the veru.

Case 2. Papilloma of bladder; cyst of prostate; adenomatous bar at bladder neck.

Dr. N. W. (31271), sixty-six years of age, consulted me June 1, 1923, because of a slowness in urination, which had existed for years, and the need for arising every two or three hours by night to pass his urine during the preceding few months.

The significant items in his previous history were a chancre on the finger some twenty years before and a gonorrheal conjunctivitis of the left eye which had cost him his sight.

The patient was a rather flabby, pallid man.

General physical examination negative.

Reflexes of eye, knee and ankle normal.

Prostate rather boggy and twice the normal size.

The urine contained pus, bacteria, a trace of albumin, no casts, no sugar.

Wassermann reaction negative.

The cystoscope obtained about an ounce of residual urine; showed a mild cystitis; much trabeculation and a small papillary growth back of the right ureter, and a bladder neck deformed by a slight bar for-

mation, and a cyst growing from the upper half of the right lobe of the prostate.

The cystoscopic picture was the same as in the previous case, but that experience led me to suspect that the tumor was not a solid one. I was unable to transilluminate the cyst, which was about the same size as in the preceding case, and occupied the same position.

Two specimens taken from the papilloma by cystoscopic forceps were reported as follows:

"Specimen consists of two small bits of tissue, sections of one showing fibrin, serum, hemorrhage and cellular infiltration.

"Sections of the second show a few transitional cells in papillary arrangement which are moderately anaplastic and showing no mitoses.

"On account of insufficient tissue, the diagnosis of carcinoma cannot be made but a diagnosis of papilloma is justifiable."

The papillary tumor was burned with the d'Arsonval current on June 7 and 20 and again on July 14, 1923.

On October 1, 1923, cystoscopy revealed no tumor of the bladder and I punctured the cyst of the right lobe of the prostate, discharging a thick fluid and depositing a radium seed (0.5 m.c.) in the cyst. No irritative reaction followed, and cystoscopy on March 26, 1924, showed that the patient emptied his bladder. The right side of the bladder neck was entirely concave, but the left side bulged the least bit. The slight prostatic bar was still in evidence. The infection had cleared up. The papilloma was not to be seen.

I examined the patient again April 28, 1925, about twenty months after the radium implantation. He declared his condition entirely normal. I found him a little aged, more sclerotic, but the urine showed only some urethral shreds. There was no residual urine and cystoscopy showed no change since March, 1924.

DISCUSSION

Dr. Benjamin S. Barringer (New York): Speaking of Dr. Keyes' paper, just one word of warning—I had a case a couple of years ago which was sent to me as a tumor of the prostatic urethra. His sole symptom had been hematuria. I put a cystoscope in and saw what I thought was a single red cyst. It was not a translucent thing. It was what I thought a bloody cyst. I punctured it letting out a lot of blood. I saw him at irregular intervals. He lived out of town, but he came back with a definite tumor of the prostate about six months later. I promptly opened him up and put radium in, and he is under control now.

I think there is a warning about these cysts. They are sometimes red not translucent, and if they are they may certainly be malignant, and I am very much on the lookout for any malignant changes.

Dr. John H. Cunningham (Boston): The report on cyst and prostate is one that interests me. I reported on the subject in 1915 before the Society, recording the case of a man fifty-eight years of age with a complete retention of urine, and a prostate which was bulding into the rectum not unlike a very large benign prostate, for which it was mistaken.

He was put on catheter drainage for twelve days, following which we did a perineal prostectomy and opened into a cyst about the size of a lemon. What Dr. Barringer says about malignancy associated with a cystic condition of the prostate was borne out in this instance, because associated with this cyst was carcinoma of the gland. That cyst was large being the size of a lemon. In looking over the literature, I found another large cyst reported by Quivane, dermoid in character and also about the size of a large lemon. These were the two largest cysts at that time on record.

Dr. EDWARD L. KEYES (New York): My compliments to Dr. Bryan on his case of extra-bladder urethrocele, that has been reported in this country, though I venture to differ with him in not believing that the bladder could conceivably mechanically have been the real tumor. The bladder extrusion must have been secondary to the urethrocele, which, acting like a child's head at the cervix of the uterus, would dilate the urethra and come down and bring the bladder out with it.

As to Dr. McCarthy's case: I have implanted quite a number of ureters, and they have all had colics and infection and very stormy times when they had normal ureters implanted, because I could not implant them without kinking them, but I was fortunate enough to get one fellow with a great big ureter like a rubber pipe which I simply implanted in his belly wall, and he never has had a symptom since. He is practicing medicine, playing football, going in swimming and has married since he had his operation.

Dr. ALEXANDER RANDALL (Philadelphia): I would like to show a lantern slide of a case of cyst of the prostate found at autopsy. Curiously it is like the ones reported and involved the right lobe. It was rather deep-seated, and projected into the bladder just exactly as you would find an enlarged lateral lobe.

There is one thing in the treatment that I question, and that is whether a radium seed would completely destroy the secreting membrane. This specimen had a very definite lining membrane, a cavity probably the size of a thimble, and I should think that a thorough cauterization with some strong caustic would be better treatment than trusting to a seed of radium destroying a membrane as large as happened to be in this individual case.

Dr. JOSEPH F. MCCARTHY (New York): I have nothing to add except that the size of the ureter that was implanted in the skin permitted easy entrance of a 30 French tube, endorsing what Dr. Keyes has stated.

A REVIEW OF THE SUBJECT OF STENOSIS OF THE NECK OF THE BLADDER, EMBRACING THE TITLES OF CONTRACTURES, SCLEROSES AND BARS

CHARLES H. CHETWOOD

New York

This review or report upon the subject of orificial obstruction of the bladder is not with the purpose of contrasting the earlier and later opinions of thosewho have contributed to it, nor to criticise the changing positions that have in some respects, been made necessary by ripening experience, but rather, in summarizing its historical development, to reveal a gradual alignment of opinion and a progressive tendency toward an understanding if not entire agreement. This "getting together" is evident from an extensive study of the literature in this country and applies also, although to a lesser degree to the European point of view. It is purposed herein to embrace under the same heading, all types of obstructive conditions that interfere with or cause deviation from the normal outlet of the internal orifice of the bladder, not properly belonging to the classification of adenomatous prostatic hypertrophy or of malignant neoplasm. The modern Tower of Babel epoch was probably when the Senior Keyes endeavored to meet the situation caused by a confusion of terms by grouping the conditions variously named under the general title of contracture. This was met with some concurrence but at the same time was followed by increased discussion owing to the description of different pathological findings.

The French authors had written voluminously of "prostatisme sans prostate" referring to valvules, brides and barriers, which we copied with reports of valves, bars and contractures. The Germans contemporized with numerous cases of the atrophic prostate and then the stenotic prostatic atrophy. Then

came the group of accessory glands, the subcervical glands of Albarran and vicarious glandules enmeshed in sclerotic tissue laterally as well as centrally. And finally hypertonia and spastosis. Many of the foregoing conditions when investigated were found to present kindred pathologies.

Most writers acknowledged the rôle of inflammation as an etiological factor but the recognition of accessory glandular composition introduced another inherent factor of hypertrophy, congenital or acquired. Primarily the difference is a pathological one; the mechanical situation may be the same, whereas the treatment has to vary in accordance with the existing conditions. For example, there is the so called Bar at the neck of the bladder. Many writers have referred to this as due to adenoma of Albarran's glands, while there are numerous cases of this same type of obstruction that are sclerotic and fibrotic in texture and which all observers would embrace under the title of contracture.

Mercier and Civiale both produced instruments, one to be used through the urethra and the other through a median lithotomy perineal wound to cut a right-of-way through these obstructions. It is on that account and because of the unsatisfactory outcome in the recurrences early and late that so much has been done and so many have tried to meet the situation with an improved technic that would overcome the difficulties encountered. That this was not an easy matter is evidenced by the changes in the methods adopted with varying results in the past fifteen to twenty years. While we have been grappling with the question here in America they have also been attacking it in Europe and are apparently slowly but progressively reaching the same understanding as ourselves. The writer published a paper in 1905 (1) entitled "Prostatism without enlargement of the prostate" emphasizing the frequency of occurrence of the condition and giving a schedule of cases. Practically every year from 1905 to 1915 the writer contributed additional articles upon the same subject (2, 3, 4, 5). In 1915 Randall (6) summed up the literature to that date.

During the years of the war and immediately thereafter not much was written until Buerger's (7) study in 1919 which con-

tained a definite statement of the classification of pathology that was approved by Young (8). Lowsley (9) seems to have stressed the importance of submucous adenomatous tissues which Buerger considered a merely incidental accompaniment of true fibrosis that bore no influence upon the symptoms of contracture. It is strange that in so large a publication and so late as 1923, the Encyclopaedia Francaise d'Urologie, we find that contracture of the bladder neck is discussed with great brevity. This work comprises six volumes containing from 1000 to 1100 pages and yet under vesical prostatism, in the large volume devoted to the bladder, there is no allusion to it. The equally large volume on the prostate is by Marion (11), one of the master prostatectomists of France, as some years ago he was supposed to have passed the one thousand mark. Marion seems to be one of the modern sceptics on the subject under discussion, for while according to his writings, he does not disbelieve in the existence of vesical prostatism yet he has never seen a case. He recalls that years ago Albarran enucleated a prostate that was quite normal while the patient who had prostatism insisted that his prostate be removed; he obtained no relief from this removal. And yet Marion shows considerable familiarity with American literature. The description in this article denotes that the vesical prostatism of Guyon and other early urologists resembles the symptoms of ordinary prostatism but there are no lesions discovered anywhere in the urinary tract. The prostate is normal to rectal touch and the condition is a functional one, the musculature of the bladder being at fault, showing more or less atony. Furthermore the description of Civiale and other older urologists with their crude diagnostic resources made the diagnosis of atony of the bladder in conditions which are now easily recognized as slight enlargement of the prostate, according to Marion. He seems to think that his views are those of the majority and he speaks of the believers in the structural theory of the disease as though they were a small minority. He mentions the writer as an advocate of the structural theory, also Keyes and Cholzoff, while Young and Buerger and other Americans receive passing mention. He also names Barth and Grosglick and Caesar as

advocating the theory that this condition is due to atrophic prostate which he contraverts. Marion does not deny the existence of the familiar condition of the prostatic symptoms without gross enlargement of the prostate, as indicated by rectal touch and nonresistance to the passage of instruments; but he indicates that it is due to a variety of causes. He is also unable to understand how an instrument can pass if there is contracture of the neck. The basic condition, he considers, or the basic cause, is chiefly muscular insufficiency. Reference is made to the neurogenic group in which the central nervous system is at fault, with which of course we are familiar; then he refers to the functional neurosis as well, which we in this country usually designate as spasm, its etiology being entirely apart from the subject under consideration.

To consider spasm of the bladder neck further under this heading would make confusion as it is entirely a reflex phenomenon and transitory in character. It is necessary also to give only brief mention here to those types of bladder retention that have not a direct bearing upon the subject under discussion, except in the matter of differential diagnosis, and thus to avoid errors in treatment and perhaps unnecessary surgical intervention. These cases are those dependent upon lesions in the central nervous system so located as to involve the nerves supplying the vesical sphincter and bladder outlet. Whether or not operative intervention is warranted in any of these cases in which there is a central nervous lesion even though there be a coexistent local lesion, is a question that is not to be discussed here. We are entirely concerned with reviewing the main subject of contracture of the neck of the bladder for the purpose of emphasizing its independent entity. If we do not adhere to an agreement upon certain characteristic features, now recognized as such, our understanding of this subject will continue to be obscured.

"Atrophy of the prostate" was a favored designation of the small fibrotic prostate for a long time in Europe and to a certain extent in this country. Zuckerkandel (12) characterized cases of atrophy of the prostate as being in reality miniature hypertrophy in which either the middle lobe or the submucous glands were involved. This is an example of the close alliance between

all of the lesser lesions that obstruct the vesical outlet, as distinguished from the major condition of lobular adenomatous hypertrophy.

Dubs (13) discusses a case of "stenotic atrophy of the prostate" in which he excised a wedge from the bladder neck. This was found, on biopsy, to be cicatricial and senile atrophy. He reports also similar cases of other writers, namely, Kummel (14), Sussergath (15), Posner (16), and Barth (17). The last author describes the conditions of atrophy of the prostate as being similar to that of the French "prostatisme sans prostate."

Many other cases are cited by foreign authors (18, 19, 20, 21, 22, 23), of nucleation of the small (atrophic) prostate under the appelation of protatism without prostate.

Cholzoff (24) (St. Petersberg, 1910) seems to have been the first European to accept the existence of the malady under discussion as described in America and he contributed a paper on "Chronic contracture of the neck of the bladder." He operated through the perineum and employed a galvano cautery incision.

In appraising further the European viewpoint on this subject, we note a contribution by Rubritius (25) of Vienna. This article "Hypertonia of the sphincter," published in 1923, upon its surface would appear to refer to a functional difficulty but one case at least reveals a condition of muscular hypertrophy of the neck of the bladder presumably of congenital origin which corresponds with a condition described by Young (26) and encountered also by others, a condition that exists without inflammation or fibrosis and therefore, while not a contracture under the general acceptance of this term, yet is an organic obstruction of the bladder orifice and should be embraced in a discussion of the subject under consideration. Rubritius' other cases are found to be due to disease or injury of the spine and are therefore of a different nature. This article furnishes further evidence of a continued lack of understanding, unintentional of course, between the American and foreign authors upon this subject. Despite the expression "prostatisme sans prostate" that appears so often in the French writings and though Rubritius mentions the enormous literature under this title, yet he supplies a contribution

in a series of cases of "Hypertonia of the sphincter" which, as mentioned, are for the most part due to injury to the spine and consequently neurogenic. Therefore Rubritius does not carry conviction as having a perfectly clear conception of the malady; he designates the lesion studied as hypertonia which in effect is a spastic state, and does not clearly indicate what is behind the tonic or chronic contraction. There is evidently some pathologic condition present for his observation involves the cutting out of a wedge-shaped piece from the internal orifice through a suprapubic opening, an operation that is not original and has undoubtedly been performed by many. This author apparently recognizes the frequent confusion of the functional with the structural trouble in non-prostatic retention and the existence of inflammatory and cicatricial contraction of the bladder neck as well as musculo-barrier formation. For he mentions a condition as described by Keyes, Young and Chetwood but concludes that his cases are radically different and he seemed to have missed Young's mention of congenital hypertrophy of the sphincter in alignment with his own. In reverting to the time when Bottini described his method of galvanic incision of prostatic hypertrophy he mentions the German disciple of Bottini, Freudenberg, as using an apparatus for incising a hypertonic sphincter to secure relaxation but he states Freudenberg's patients seem to have had tabes dorsalis. Apart from the question of diagnosis, in reviewing this author's work, it is to emphasize that his method was a direct attack upon the neck of the bladder for removing a wedge-shaped piece to correct a permanent obstruction accompanied by a functional deficiency. It is also in point to take note of the fact that his line of thought has been in the same direction as that of all who have given this subject sufficient study; for in commenting upon the operation of sphincterotomy, which in simple terms implies incision of the neck of the bladder, he recalls, what we all have or should have constantly in mind, that this operation has been done continuously for one condition or another since the time of Mercier, who devised an instrument like an urethrotone used also by other Frenchmen in a similar connection. The Mercier type of instrument had been used both

through the urethra and through a perineal incision. Then came Bottini who introduced his galvano cautery instrument for use through the urethra, and Freudenberg's modification. There was also a Young modification of the galvano cautery instrument but later Young constructed an instrument for a punch operation which this author refers to as a trigonotone. He also mentions the Chetwood galvano cautery knife, used through the perineum, as one of the expedients adopted.

When Buerger (7) attempted to cover the subject and standardize our knowledge of the pathology in this connection, the term contracture was used to embrace all processes involving the region of the internal sphincter and contiguous periurethral tissues in which no neoplastic tissue was concerned, such affections having a common result of distorting or obstructing the urinary canal. This is the only basis upon which an understanding can be reached, be the nomenclature what it may, for it describes an organic chronic lesion benign in type. It excludes functional conditions and those of the central nervous system. The term median bar is to be avoided except as a description. It is not to be used to designate a separate malady as it possesses no symptoms peculiar to itself differing from other formation of contracture. Buerger decided that contracture was not an adenomatous tissue, as might be inferred if a small amount only were removed of the sphincteric region, but that the lesion was of deeper anatomic structure. He found that the pathology varied. It might be a simple fibrosis, with or without inflammatory etiology; a glandular invasion encroaching upon the orifice with or without inflammation; and, finally, mixed forms of the foregoing complicated by added units of fibromas or adenomas. This would seem to cover all of the pathologic variations in the majority of instances as it embraces a single and miscellaneous type of same.

Young (26), who made an earlier study than Buerger (7) of portions of tissue from the bladder neck, removed by operation, embraced in different terms all the standard varieties named by Buerger, but emphasized the occurrence also, although of lesser frequency, of congenital muscular hypertrophy. To these should be added, as well, congenital anomalies of the mucosa and sub-

mucous structure. While it may be remarked that the evidence of pre-existent or present inflammation may be absent with these congenital formations, and thus the commonly encountered symptomatology of contracture be lacking, yet it is so frequent that inflammation does supervene and is the means of bringing to light the existing condition that it would seem consistent, with proper identification, to embrace these lesions in the general classification.

In connection with Buerger's observations of the pathology in 1919 it is interesting to me to take note of the paragraph of my article published in 1905 which states that "contracture of the neck of the bladder is in substance a fibroid stenosis of the vesical orifice" not a hyperplasia of the muscular elements of the sphincter or of the adenomatous tissues, not a simple spasm or a mucous fold but a fibrous infiltration, inflammatory in character. I have frequently called attention to the peculiarity of the tissue associated with tactile sensibility. It is either obstinately unyielding, cracking or splitting under pressure, and comparatively hard, or inelastic, according to the degree of involvement. This is contrasted with the normal sphincteric orifice which is likened to that of other orificial sphincters, gripping the finger but yielding to pressure with an elastic and velvety sensation. Buerger remarks that when the finger is inserted into the orifice an annular band is felt which is hard, fibrous and infiltrated "the finger cannot enter without tearing the tissue which usually gives way in front or above. The feel is quite unlike that of the normal urethro-vesical outlet which is elastic and resilient." Buerger then describes in detail the composition of the inflammatory fibrosis-glandular formation, following which he describes an operation of removing a section suprapubically. The result of this radical removal of a substantial section of the obstructing bladder orifice was very effective being about 75 per cent. successful. There were two failures, however, raising the question as to whether or not the actual site of obstruction or cause thereof had been reached even by this direct attack. In the discussion that followed Buerger's paper there was a general consensus agreeing with his views on the pathological classification.

Randall (27) ("Median Bars as Found at Autopsy") analyzed 300 cases, 18 per cent. (54 in number) examples of "bar" obstruction. These were divided according to gross and microscopic pathology into: (*a*) Fibrotic infiltration of posterior orificial lip, fore-shortening the distance between it and veru-montanum; (*b*) a fibrotic bar-like formation with its tenticular extensions posteriorly, rather than anteriorly, toward the vesical trigone and having a resulting tendency to contracting the transverse distance; (*c*) a bar showing undoubted inflammatory elements in the thickened cellular and connective tissue formation overlying a deeper structure of glandular histology evidencing hypertrophy; and (*d*) in contrast with the foregoing, isolated units of glandular hypertrophies such as are designated Albarran's subcervical glands. This last is prone to assume rather the lobular than the bar formation. This is a transient type in its topography between the so-called third lobe prostatic and the prostatic bar. Evidence of preëxistent chronic inflammation (prostatitis, etc.) was found by Randall in all cases as an etiological factor. It was emphasized by this writer that there existed a tendency to confuse ourselves by the term fibrous prostate; that a fibrosis was not a hypertrophy. It should be equally emphasized, however, that this is an academic distinction and, in the light of our knowledge of the frequency of mixed pathology, many of these lesions properly come under the same classification, on account of both the symptomatology and the indication for the kind of surgical treatment adapted to them.

Edwin Beer's (28) "Some observations on contracture of the neck of the bladder" raises the question of the onset of this affection in childhood on account of his observation of cases of "Retention of urine in boys." Seven of 11 of such cases were probably examples of contracture of the neck. He mentions the usual group of characteristic symptoms and the cystoscopic picture. The plan of treatment favored was that of a suprapubic opening allowing complete diagnosis and broad excision with scissors. Even with such radical means there was not, however, entire freedom from relapse, which happened in 1 of 7 patients after several years of immunity. Since this author published

his original paper on this subject he has seen 20 new cases (29) in young boys of chronic retention due to a congenital fold of the mucosa just back of the bladder neck. Operation consisted of suprapubic cystotomy and resection of V-shaped wedge. These examples furnish ample testimony of congenital anomalies as potential contractures.

Gardiner's (30) contribution on "Urinary obstruction without prostatic enlargement," in Cabot's "Urology," describes three structural types which practically conform in terms to those already emphasized.

The importance of the accessory glands as a contributory factor in the causation of obstruction at the vesical orifice is attested in many quarters. That the glandular composition is not confined to the subcervical group is revealed by an examination of the different sources of information available. It is evident that while the subcervical glands are often the seat of hypertrophy, adventitious growths are found laterally, on the summit and, proximally, on the floor of the vesical outlet. These may or may not be enmeshed in sclerotic tissue. Many foreign authors in support of native observers have reported cases where the cause of retention was small adenomatous obstacles in the vesical orifice which were detected by endoscopic examination or discovered in the tissue removed by excision. [Vide Carraw (31) (Milan), Lilla (32) (Leghorn), Devrage (33), Aschoff (34), Phelip (35) (Lyons), Praetorius (36) (Munich), Von Rihmer (37) (Budapest).]

Lowsley (38) in an extensive report entitled "Observations on certain obstructions of the vesical orifice" went into the subject historically and anatomically. He stated then that he found the Young punch operation decidedly the best method (speaking of the hypertrophied subcervical group of glands) for removing these intrasphincteric masses, be they small, large, unilobular or trilobular. He further stated that these tumors have been treated by the high frequency current with splendid results in some instances but that occasionally the application of the high frequency current has been followed by severe infection. In the discussion that followed Lowsley's paper, Plaggmeyer (39)

(Detroit) recalled his experience when helping Young, of noting a number of recurrences, apparently, following Young's perineal prostatectomy. Investigation revealed a small glandular knob, enclosed in its own capsule, at the site of the subcervical glands of Albarran which was capable by its presence of producing as much as complete retention of urine.

In an epitome of the operative procedures, universally adopted for most of the cases reported, we find ample support to warrant the question of a choice between an open and a closed method, that is to say, a trans-urethral operation, or one through a perineal or suprapubic wound.

Young (40), who is the pioneer of the modern trans-urethral technique, the so-called "punch" operation, records his experience in 1919, when a patient with complete retention and no prostate, following a suprapubic section of the internal orifice, died from uremia. It was following this episode that Young devised his punch instrument for the purpose of excising the median portion of the prostate through the urethra.

The punch operation apparently encountered post-operative difficulties with early cases which led to the change from a practice of continuous irrigation to a kephalin coated catheter (26, 27F.) by which change it was noted that "hemorrhage usually ceases and gives little trouble," yet it was important in the after treatment that a "good piston syringe is at hand for prompt evacuation of all clots." In the analysis as to etiology, inflammation, recent or remote, seemed the usual factor. It is stated there have been no complications except hemorrhage: "Usually the bleeding is small in amount . . . . but in a small number of cases it has been rather profuse." A specially devised catheter was employed to avoid trouble with hemorrhage. In summary Young states that to remove "small obstructions at the prostatic orifice is all that it is intended to do" and further that "it is not an operation for general usage," which is obviously the case as the determination of the question as to what may be the limitations of a so-called "small obstruction" is not for general understanding.

Bugbee (41) describing the "Use of high frequency for median

bar obstruction" excluded lateral and anterior lobe enlargement and complete fibrous ring. The type described was of a "thickened edematous mucous membrane; of a connective tissue layer beneath or involving the mucous membrane; of inflamed submucous glandular tissue and infiltration; of hypertrophic glandular tissue; or of hypertrophy of the sphincter." At this writing Bugbee, having taken note of Young's results with the punch operation decided in favor of this procedure for the attack upon the type of obstruction producing a hard fibrous ring wherein was required the removal of four to six pieces of tissue. Bugbee further commented upon the difficulty of applying the high frequency treatment to clinic patients on account of the prolonged periods required and the lack of control, on which account the punch was more suitable, confining to bed and completing treatment at one time. Raymond Stevens (42) also endeavored to reduce obstructions at the bladder neck with the high frequency (Oudin) current. Heitz-Boyer (43) in the European field besides coöperating with Luys' work of "forage" of the prostate (q. v. seq.), made use of the high frequency current through a suprapubic cystotomy wound.

In the discussion that followed the previous reports the high frequency current method was discredited (Braash (44)) on account of its being inadequate to the purpose and tedious. Also the haphazard removal of tissue at the vesical orifice, without being certain that such tissue was obstructive, was not justified. Braash then introduced a modification of the Young punch instrument constructed upon the lines of the direct vision cystoscope designed to permit the technic of removal of portions of the bladder orifice by way of the urethra under direct vision of the operator. In the same discussion Keyes (45) announced the rude awakening from an earlier dream with respect to the utility of the so-called Chetwood technic because of the constancy of relapses since an earlier favorable accounting (46) upon his experience which, however, took as long as five to seven years to appear. This speaker questioned the adequacy of the high frequency treatment and doubted the permanency of the results following punch operation. He queried the advantage of removing by

suprapubic section intraurethral lateral lobes which project within the sphincter not visible by cystoscopy. The fact was brought out in the discussion of another contribution that a single incision, no matter how extensive, cannot be depended upon to cure all cases, for in addition to posterior there may be anterior or lateral angles of interference, on account of which Young has used his punch both anteriorly and posteriorly. Quinby (10) then endorsed Young as to the necessary at times for anterior and lateral incision.

In closing the previous discussion and responding to the question as to late results Cecil (47) stated that "the punch operation has been done in cases which were not adapted for its use and for this reason it should not have been done," which is to state, that the results in such cases were not satisfactory. This unfortunately is likely to be the case with the introduction of many new procedures especially when the number of cases mounts so high that the impression is given of an unnatural prevalence of a given malady. The speaker's frank statements convey the impression of a high percentage of recurrence. "It (the operation) has been done when there was a bad cystitis and evidently a bar was present but the cystitis has continued and the patient's symptoms have continued. Where there has been a small hypertrophy, the patients have been improved, but these patients come back later with hypertrophy and some have required a prostatectomy." From a pathological standpoint the patients not relieved were those having a persistent inflammatory process as the condition tended to reproduce itself. Whereas when there was hypertrophy, although the obstruction was relieved the hypertrophy continued and the *result was not lasting!*

Day (48), a colleague of MacGowan, writing on "Contracture of the bladder neck" refers to four procedures: (*a*) The Young punch; (*b*) MacGowan's modification thereof, in which a suprapubic or perineal opening is made; (*c*) Bugbee high frequency; (*d*) his own method in which he cooks the tissue and then punches it out (1) through the urethra (if in the office) or (2) through a bladder opening (in the hospital).

At the 1922 meeting of the American Association of Genito-

Urinary Surgeons, Geraghty (49) presented an instrument designed for the treatment of certain cases of contracture by sphincterectomy, somewhat after the type of the Young punch. In the discussion that followed stress was laid by a number of observers upon the *prevalence of hemorrhage* following these intra-urethral expedients which however it is claimed is dispensed with by the addition of the galvano-cautery feature of the newer Caulk technic. This author's method is making an impression on account of its practicability and efficiency as demonstrated in the hands of its sponsor, who states "if there are recontractures I am willing to go back and cut again;" and this is the crux of the whole matter. But the natural query arises, if we find that most patients are to be resubmitted to operation for their trouble, what is the longest period for which we can assure them immunity and what is the expedient that will give them the best that it is possible to attain out of their given situations?

Parker (50) in a long technical article concludes that posterior median bars (excluding the Albarran gland type) are not so common as has been believed. A wide collar type of obstruction is the most frequent cause of progressive vesical irritability and retention in the fourth and fifth decades. As to the causation, these conditions may be set up by focal infection and systemic toxemias in addition to local inflammation. Parker favors the Young punch operation as modified by MacGowan and himself which also embraces resort to the suprapubic route and an external urethrotomy. The lack of illumination in the last method is compensated for by the superiority of digital diagnosis. The object stated, which has a "home like" sound to the writer's ears, is to bring the floor of the bladder on a plane with the floor of the posterior urethra. This author calls for a better explanation of how changes in the tone of the bladder neck are able to produce vesical irritability—hypertension of the muscle—in connection with these mechanical contractures.

Legue (51) in his treatise (Paris, 1921) devotes less than a page to this subject of "prostatisme sans prostate" and he quotes no American urologist. This condition was prevalent in his last 300 operations there being seemingly 78 that would come under such

classification. There were three degrees or types of cases: (*a*) An adenomatous growth visible to the naked eye although hidden, enmeshed, in hypertrophied muscular tissue; (*b*) adenomatous tissue only to be distinguished in microscopical sections; (*c*) no adenoma the "hypertrophy" being composed of fibrous and muscular tissue. As a class these lesions shade into the ordinary prostatic hypertrophy. This observation would seem to coincide with the views expressed here of the classification of these cases by their pathological composition and as a further corroboration of the frequent occurrence of composite types. He does not draw, however, the sharp line of distinction between the sclerotic or fibrotic types and the hypertrophic or adenomatous variety that is drawn in America, and which has its principal importance in furthering an understanding of the etiology thereof. Legue says little of the treatment of these cases of prostatism without a prostate, although he evidently practises excision, as he states that in the series of 78 cases not over 15 grams of tissue required removal.

Pisani (52), Milan "Urinary retention without prostatism" describes alterations of the bladder neck in this condition comprising changes in the periurethral tissues, extending from the mucosa of the prostatic urethra into the structure of the smooth muscle of the sphincter. All of the tissues that enter into the formation of the neck of the bladder are involved. While these changes do not produce obstruction they do produce a marked influence upon the normal contractility and elasticity of the neck of the bladder. The author has no question as to the rôle of inflammation in the majority of cases while in doubt as to the order of development. Operation is invariably by suprapubic technic with excision of a wedge piece of tissue which is submitted to microscopic study.

Voelcker and Wossidlo's (53) treatise seems to coincide with our views more closely than any other foreign source so far investigated. It records that there are pathological states which by presenting pictures of chronic and acute retention fully resemble prostatic hypertrophy but differ radically because enlarged prostate is absent. These conditions, which comprise various

pathological states, are known collectively as prostatism without prostate. They are classified as follows: (*a*) Atrophy of the prostate where there is fibrosis without any tendency to adenomatous hypertrophy, the gland decreasing in size instead of increasing; (*b*) hypertonia of the sphincter, a spastic state of the occlusive muscle, seen in children and young adults, often extremely chronic and obstinate, accompanied with complete or incomplete retention of urine; (*c*) hypertrophy of the sphincter. This is a genuine hypertrophy of the occlusive muscle, congenital or acquired, seen especially at the posterior margin of the sphincter and there is no obstruction encountered by the catheter; (*d*) sclerosis of the sphincter—a chronic inflammation of the prostate with a hard fibrosis in the region of the occlusive muscle. Retention and cystitis prevail. Usually the catheter meets no resistance. The condition is rebellious to treatment by antispasmodics and dilatation. Good results follow operative division of the sphincter. Better results are attained if this is preceded by suprapubic cystotomy as the sphincter may then be inspected and palpated. The sphincter may simply be divided but it is often better to excise a wedge from the muscle.

John R. Caulk (54) reporting before the New York Urological Society, June 1923, on 100 cases of selected vesical neck obstructions, divided the types, according to the degree thereof, into, (*a*) "slight vesical ingrowths completely encircling orifice;" (*b*) a second class more pronounced in which, besides collar formation, there may be shallow clefts; (*c*) still more bulging and deeper clefts (in this class are included lobular protrusions in which the sections of tissue removed have revealed varying proportions of adenomatous and connective tissue), and (*d*) a type that comprises dense sclerosis and is composed of dense scar tissue. Very rarely have there been glandular elements. This classification of Caulk fails to draw a distinct line between the connective tissue and the glandular composition of vesical neck obstructions, which, while in reality theoretical only, should be adhered to not simply as a matter of classification but as an aid to a better understanding of what has happened to the various cases under different measures of treatment in the past and what is to be expected of them

in the future. This combined pathology in the different growths of any group of cases reported emphasizes the fact that, while we may classify our cases as those of purely fibrotic or connective tissue elements and those of a glandular composition, yet in reality in any series of cases there will exist a merging in various degrees of these two, so as to make the exact division possible only in the extreme instances of both types. In connection with this series of cases the author remarks that "very few of these patients show much rectal enlargement. This is very important in predicting that the patient may be suitable for the punch operation." As to the condition of the prostate gland it was noted that it was slightly enlarged in 45 and considerably in 11 out of 79 patients. (Note: The total number here is given as 90 but as in only 79 is the situation noted the proportion cannot be stated beyond 79.) In 23 there was no enlargement, and while it is stated there was little or none in 68 out of 90, strictly speaking there was little or much in 56 out of 79. In this series of cases the urine was infected in 58 per cent. In 50 cases additional to the foregoing Caulk reports that the analysis is identical in almost every respect to the previous one, which is evident from a review of the cases reported.

In Europe, Luys (55) and his co-workers have followed a somewhat similar technique, entitled "Forage" of the prostate, but in a less selective manner. And yet when noting the accumulating material of our native exponent, Caulk, we find that, beginning in 1920 he first reported, before the American Association of Genito-Urinary Surgeons upon the use of his instrument for bladder obstructions in selected cases. At that time he stated that, except in a limited number of cases the punch instrument should be confined to cases of contracture of the vesical outlet and that "it is certainly not suitable in cases of hypertrophy of the prostate." In 1923 there seemed to have opened an increasing field of usefulness for his method as based upon an analysis of 100 cases. Further on, adding 50 more to the 100 cases reported the gradual application of this method to larger obstructions was demonstrated and finally with 25 more cases bringing the total up to 175 in June, 1924, there had been established (since

the last report, November, 1923, a period of about six months), an even broader field of application leading the author to believe in the existence of a growing tendency to reduce the number of prostatectomies for bladder neck obstructions. In fact in the previous six months 50 per cent. of all obstructions had been treated by the improved technic. Thus it will be observed much favorable testimony is afforded in behalf of the intraurethral operation. Many surgeons, however, still prefer the open method of operating, as gleaned from an exhaustive examination of the records.

The addition of the galvano-cautery feature to the punch technic, in view of the possibility of hemorrhage without it, is an appealing and important expedient. Such being an accepted fact, there still remain two outstanding questions: (*a*) consideration of the degree of precision by which many of these complex conditions may be completely mastered by intraurethral approach; and (*b*) of paramount importance, that of the degree of permanence that may be expected therefrom.

Having been an advocate of open operation for most of the cases requiring operation, most of my experience has been along that line. That excellent results have been obtained by open operation, there can be no denial, and in many instances these results have been maintained over a long period. The favorable application of regional anesthesia to the technic, simplifies the open procedure. The use of new and specialized modalities may afford a still greater merit. My records reveal one patient who reported sixteen years of immunity after operation; another after fifteen years has no residuum; another, in which there had been complete retention, persistent in degree prior to operation, I find in excellent bladder condition after seven years. The cases were treated by open operation and galvano-cautery. More recently are cases relieved, so far as present report can be made, by open operation and diathermy incision.

It seems reasonable to state that in spite of the success of the closed method, even so dexterously handled as is reported, there are some cases that can be approached with greater satisfaction by open operation because of the possibility of more complete

diagnosis, and of the attendant condition of chronic inflammation, etc., benefited by the drainage instituted.

CONCLUSIONS

1. Contracture of the neck of the bladder may embrace in classification a variety of conditions that have in common one principal feature, namely, obstruction to the urinary flow at the bladder outlet.

2. It may be encountered therefore as a congenital or an acquired condition.

3. Inflammation plays the important rôle in most instances, for it is either predisposed by the existence of an obstruction, or is itself the cause of the growth of pathological tissue by which the obstruction is produced.

4. This dual condition of inflammation and obstruction constitutes the *symptom compound* of contracture.

5. While in diagnosis its different pathological forms are to be identified it is mainly to be distinguished from the two other major maladies that occur in the same vicinity, namely, benign prostatic hypertrophy and malignant neoplasm.

6. As to pathology, the structure composing contracture of the bladder outlet is that of the histological tissue proper of the region and such pathological changes as may be added thereupon. These changes consist of (*a*) congenital distortions, (*b*) hypertrophies, (*c*) sclerosis. The last is most characteristic. The resulting formation is concentric or irregular, circular and lobulated. This is owing to the fact that the composition is of a mixed character and that while fibrosis is a predominating element there are frequently miscellaneous combinations.

7. Treatment.

HISTORICAL DEVELOPMENT

These conditions have been attacked by open and closed methods of operating for all time. Such methods have involved simple incision and the excision of portions of tissue in single and multiple units in single and repeated procedures. Such pioneers as those earlier mentioned designed instruments for use with and

without a surgical opening for their introduction—Oh there were bloody sessions and lurid aftermaths.

Today we find the same choice of procedure with the modern refinements or accessory expedients added thereto. These procedures embrace the technic of single incision, multiple incision with or without removal of one or more portions of the tissue involved. These incisions are made with a cutting instrument alone (knife, scissors, roungeur, gouge, urethrotome, punch) or with any such instrument with the combination of the modality of thermo, galvano, or diathermic cauterization.

If unable to agree upon the proper selection of technic to be adopted for all cases, nor yet upon the percentage of cases that should be attacked by any one technic, this much can be stated in brief: that the object of operation is to obtain the maximum of symptomatic relief, with the most complete removal of the underlying cause, for the longest period of time. The question of the degree of permanence of results can only be determined by patiently awaiting the accumulated evidence of the future.

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THE FALLACIOUS ORIFICE

CONTRACTURE OF THE VESICAL NECK

JOHN R. CAULK

St. Louis, Missouri

Received for publication June 15, 1925

In this discussion of the "fallacious orifices," I have chosen the qualifying word "fallacious," not according to its ordinary meaning, as something false or untrue, but to express the idea of something deceptive and calculated to mislead the mind or eye, because there is no subject to which this definition can be more apposite than when applied to prostatism, and particularly to that form resulting from contracture. This is quite at variance with the usual conception of the contracture picture which has always been designated as an orifice constricted by sclerosis with very slight intravesical growth or rectal enlargement of the prostate; its anatomical configuration has been accepted as a well defined clean-cut entity with little, if any, change in its character from time to time. I feel quite convinced that its character is not so constant but on the contrary rather vascillating and fickle.

The prostate shows definite enlargement in about one-third of men past middle life and occasionally much earlier. About half of these suffer with discomforts of urination incident to pathological conditions around the internal orifice which interfere with the normal mechanism of bladder function. These changes at the neck result chiefly from diseases of the prostate and the glands within the vesical sphincter and have been classified into three main groups.

1. Sclerosis with the production of bars and contractures
2. Benign hypertrophies, the so-called adenomas
3. Carcinoma

Bars and contractures have been held responsible for about 15 per cent of such disorders. The clinical findings of Young and the pathological material gathered by Randall and Lowsley have borne out these figures. In the 494 clinical cases which I reported in 1920 this type of obstruction occurred in 14 per cent, carcinoma contributes about 20 per cent to such involvements. The remaining 65 per cent is allotted to hypertrophy or adenoma; thus occupying over half the chapter of prostatism resulting from certain pathological changes in the gland, the etiology of which has created considerable discussion. This growth is believed by some to be inflammatory while many have assigned to it a neoplastic origin, still others consider it the result of some secretory or sexual derangement. The most eminent pathologists have entertained heated arguments for years concerning its nature. The main theories are familiar to you all and will not be discussed in detail. They are all more or less speculative since it seems difficult or impossible in some instances to distinguish by histological examination between an adenoma and a glandular hyperplasia. An adenoma is a circumscribed glandular tumor, but encapsulated tumors may also occur as the result of inflammatory conditions. An adenoma generally departs from the true character of the gland in which it is located; for instance, an adenoma of the breast will usually give no microscopic evidence of similarity to the mammary gland, whereas the so-called adenomas of the prostate appear as modified prostatic tissue. The term adenoma is very loosely applied chiefly through usage and in many instances does not represent the type of tumor.

The advocates of the neoplastic theory have maintained that the growth is a tumor process of the character of an adenoma. Socin was one of the first proponents of this theory. Many of the French and German pathologists believe that these enlargements are a result of a benign tumor growth. Aschoff states that the majority are true adenomata, Gardener in his chapter in Cabot's System subscribes to this theory quite strongly. Among the observers who have believed such growths to be inflammatory are Ciechanowfski, Ewing, Green, Brooks, Motz, and others. Young and Geraghty believe that there should be a division into

the inflammatory and true hypertrophic forms. Geraghty holds that hypertrophy nearly always takes its origin in the glands of the vicinity of the urethra. This, of course, is the territory in which inflammatory changes should be more frequently expected.

The histological changes in this glandular overgrowth show in certain places normal prostatic alveoli, and in other places alveoli composed of many layers of cells with numerous projections into enlarged lumina. In other areas there may be dilated alveoli with cystic spaces lined by flat epithelial cells and containing desquamated epithelium and secretion. The retention of corpora amylacae within the lumina is quite common. A surrounding infiltration of the stroma with round cells, plasma cells, and polymorphonuclear leucocytes is almost an invariable accompaniment as well as various degrees of connective tissue proliferation and smooth muscle. Such a picture certainly seems to indicate a chronic catarrhal productive inflammation with unusual epithelial overgrowth. Ewing assigns an inflammatory origin to this growth, but concedes the lack of supportive facts and suggests that the diffuseness of the process and the occurrence of multiple foci with great peri-glandular sclerosis argue against the neoplastic theory. He also says that in his own material adenomata are rare in enlarged prostates.

Whatever may be the origin of these growths, this whole group of greater prostatic enlargements when responsible for obstructive symptoms requiring attention have been in the majority of instances treated by major surgery with their removal, or they have been relegated to palliation without removal, thus they have either been enucleated or left intact; in this way the chief element in the differentiation of their character has been denied.

Since being so deeply concerned with obstructive lesions at the bladder neck and the ready application of many to minor surgical measures I have had the opportunity to observe very carefully the changes in a prostate following partial removal of the gland. Let me call your attention to some of the striking transformations which have occurred. In my first report of the Cautery Punch Operation in 1920 it was utilized entirely in connection with lesser obstructions, the bars, either hyperplastic or fibrous and to cer-

tain contractures which as I see it today represent the same condition, the whole comprising about 14 per cent of all obstructions. In 1923 I found myself using this method in 30 per cent; and at this time called attention to the changes in the orifice under drainage, in 1924 in 40 per cent. During the last year it has been employed in 63 per cent of all obstructions. In analyzing 1200 cases of benign prostatic obstructions I find there are exactly 40 per cent which could be relieved by such a method, that is, the type of orifice was entirely compatible with such therapy. During these five years the ratio of minor surgery to prostatectomy has in my hands shifted from 1:7 to 2:3. This increasing application of such surgery to these prostatic growths has been due to the gratifying results from its usage, but aside from its clinical application I have had a chance to observe the changes of such orifices after a partial removal of the obstruction and to study the anatomical variations in the gland. The extra 20 per cent done in 1925 have been chiefly for this purpose.

I have followed 42 such prostates and have seen those which seemed large and adenomatous diminish to normal size with complete restoration of urinary function following the removal of but a slight proportion of the entire growth. All these cases had typical rectal and cystoscopic findings which would classify them as gross hypertrophies and ones which would ordinarily be relegated to major surgery. In a proper subject there is no question that the majority could have been more promptly cured by such means and I do not wish to be understood as advocating such a procedure as a method of choice in these large obstructions if the patient is a suitable surgical risk. My persistence with this operation in these larger growths has been stimulated by a desire to determine their nature and I am convinced that the majority are inflammatory and many have as their fundamental basis a contracture, which by its consequent insult to the vesical orifice is creative of a superimposed marked proliferative inflammatory change both within the ascini themselves in the form of epithelial overgrowths or saccular dilatations and around them a periascinir infiltration. In other cases it is probable there may be a generalized inflammatory process in the gland with its chief reac-

tion near the urethra causing a more or less diffuse obstruction to the ducts, with secondary inflammatory changes throughout the organ as was maintained by Ciechanowfski. Whether from one cause or the other, under quiet and drainage and particularly after incision of the orifice with release of tension and spasticity and possibly by drainage of certain portions of the prostate, there is a prompt resolution of this reactionary inflammation and a shrinking in the dimensions of the gland, both rectally and cystoscopically. If this growth were neoplastic such a transformation could not be expected. It is, however, strikingly indicative of an inflammatory condition with hyperplastic tendencies. I have repeatedly removed from large lateral and median lobes by means of the punch, portions of tissue which were histologically characteristic of hypertrophy of the prostate and have seen the remaining portion of the enlargement show the most pronounced retrogression and resolution.

Since we so frequently see enormous inflammatory reactions with the production of proliferative vegetative changes in other organs and structures as a result of inflammation and tension it is not unreasonable that such a process should occur in this gland which is so subjected to infections. Just recently I saw a stone in the lower end of the ureter associated with marked pyelonephritis which had created around the vesical end of the ureter a growth as large as a cherry which stimulated a tumor. After incising the orifice, removing the stone, and clearing the renal infection, this growth disappeared spontaneously in two weeks. Such changes are commonly seen around the cervix of the uterus and in any organ or duct subjected to marked inflammatory change particularly under pressure. I am perfectly convinced that this is the pathological process which is taking place throughout the substance of the prostate in many of these enlargements. Such transformation of the configuration of the prostatic orifice has been observed many times between the two acts of a prostatectomy. We have all seen instances in which at the first stage there presented a large pouting growth and at the second there was nothing left but a densely contracted neck. Within the last few months I observed a most astounding change in a median

lobe which was left for subsequent removal at a second stage. At the first operation a very large badly infected diverticulum had been removed from a subject who was an extremely poor surgical risk. This median lobe at the time of the first operation was the size of a large walnut, very firm in consistency, the mucous membrane covering it was intensely congested. At the second stage, two weeks later, after the patient's bladder had been at rest and his infection had materially cleared, this lobe had practically disappeared and there remained a contracted neck.

I will cite to you one case which stands as a most admirable illustration of the inflammatory character of prostatic enlargements. This patient, eighty-one years of age, had an enormous prostate, firm and round, about the size of a large orange; there were two quarts of residual urine with its resulting paradoxical incontinence and profound uremia. Under catheter drainage his nitrogen remained around 100 and his general condition was extremely bad. After several months of drainage he gradually improved, but even then his nitrogen was high and his phthalein showed but a trace. Although his general condition appeared quite good, it did not warrant a prostatectomy. As this patient was entirely inoperable I determined to try as an experiment the effect of the punch upon such a gross enlargement. It was at first necessary to spear the orifice with hot electric needles in order to shrink it sufficiently for the punch to grasp. After repeated efforts we were able to remove several pieces. Following this, during the course of the year, there have been ten operations by this method, 15 pieces of tissue have been removed. The bulk of these 15 bits of tissue, I should say, would not aggregate one-tenth of the size of his enlargement and yet his prostate today is practically normal in size; he has very slight intravesical enlargement, and in the beginning there were enormous lateral lobes with deep clefts above and below. He passes his urine with a perfect stream about every three to four hours in the daytime, 400 to 600 cc. at a time, gets up once at night and very often not at all, has perfect urinary control and says he feels better than he has for years. He now carries 6 ounces of residual but there is still slight obstruction. The chief point in the study of this case

is not so much the really excellent clinical result but the fact that here was a so-called adenoma of the largest type, which after the removal of a very small portion of the total growth, has shrunk to practically normal size. Nothing but an inflammatory condition could have eventuated in such an outcome.

In many contractures one gets the impression that the whole prostatic urethra is infiltrated with scar and that the gland as a whole is contracted. It has been my experience, however, that the chief factor of such contraction is at the internal sphincter and when this is sectioned and its spasm and tension released the remaining portions of the prostatic urethra are open and free.

A careful observation of the vesical orifice in obstruction is essential. A contracture may assure a variety of shapes depending upon the reaction in the surrounding parts of the gland. I believe that the contracted neck with its various configurations is responsible for at least 40 per cent of benign vesical neck obstructions and that after drainage with catheter and with incision of the orifice, resolution may be expected in the majority of instances. I am firmly of the opinion that most of the so-called hypertrophies are inflammatory in origin. If one adds to this figure the instances of cancer responsible for contraction—certainly 10 per cent. A total of 50 per cent of all obstruction will fall in this category.

If these proofs be accepted as demonstrating the correctness of the theory that inflammation is the true cause of the majority of prostatic hypertrophies, then with proper education may not many of these enlargements be avoided? If such enlargements may be expected in 30 per cent of individuals past middle life, it would seem wise and essential to institute a campaign of education among the profession to examine the prostate of all men, particularly after forty, as a part of a general physical examination, and if infection or enlargement be present though they be symptomless, treatment directed toward their correction should be instituted. If there should be easly signs of obstruction it should be removed by minor measures and in this way it may be possible to protect a large number of the population from prostatic enlargements later in life.

SUPRAPUBIC DRAINAGE PRELIMINARY TO THE PUNCH OPERATION IN SELECTED CASES

HENRY G. BUGBEE

New York

Received for publication June 16, 1925

The following brief report is made of a particularly difficult group of cases of retention of urine, as the operative procedure outlined has given decidedly more satisfactory relief than by any technique previously employed.

The patients were of the following ages—sixty-three, sixty-four, sixty-five, sixty-six, sixty-eight, seventy-three and eighty-four. Four of the cases when first seen had complete retention. Of the remaining 3, one was able to void small quantities but had 29 ounces of residual, another gave a history of retention at irregular intervals over a period of two years and had 14 ounces of residual while the remaining case had a residual of 12 ounces.

All presented a severe grade of infection of the urinary tract, the seminal vesicles being distinctly involved in each, and in 4 an epididymitis was present.

On rectal examination an enlargement of the prostate was thought to exist in each instance hypertrophy being the diagnosis. All presented a negative Wassermann and showed no signs of a central nerve lesion.

A retention catheter was employed for drainage until the patient's condition and the functional tests showed that a suprapubic drainage could be established without risk of suppression.

Cystoscopic examination previous to cystotomy was unsatisfactory in establishing an accurate estimation of the amount of prostatic enlargement as all presented considerable edema of the

vesical neck and deep urethra; however, the presence of a calculus, neoplasm, diverticulum or nerve lesion was excluded.

A cystotomy under infiltration anesthesia was carried out and followed by uremic symptoms in each case; the duration of such symptoms being from a few days to two weeks and was followed by a markedly improved general condition, together with a clearing up of the urinary infection. As their condition warranted, all were allowed out of bed and came to their second operation well stabilized.

Under para-sacral anesthesia, the suprapubic tube was removed, the fistulous tract dilated sufficiently to admit the first finger and with the fingers of the left hand in the rectum, the vesical neck was palpated bimanually. In no case was any prostatic hypertrophy present although this was the apparent pathology previous to the drainage. One patient presented a semblance of fibrous lateral lobes, but the remaining 6, only a tight fibrous ring, in 4 the orifice being so small as not to admit the tip of the forefinger.

Following urethral dilatation, a Young punch was introduced through the urethra into the bladder. The knife was withdrawn and the fenestrum of the instrument carefully fitted over the fibrous prostatic ring under the guidance of a finger in the suprapubic sinus, a good bite being taken in this constricting ring. This was repeated about the circumference of the vesical neck, in some instances as many as 12 pieces being removed, practically the entire ring being excised. There was only slight bleeding in any case, owing to the lack of local congestion, due to the subsidence of infection from the suprapubic drainage, and also to the accuracy in manipulating the punch under the guidance of the finger in the suprapubic sinus.

In 3 cases a strip of packing was inserted into the vesical orifice and brought out the suprapubic sinus to be removed in twenty-four hours and in all a Pezzer tube was inserted into the suprapubic opening. The drainage tube was removed as the urine cleared. When it was removed, the sinus was allowed to granulate, an indwelling catheter being inserted into the urethra.

The sinus closed in eight days in one case and the longest time was eighteen days. There was no reaction in any case subjected to the punch operation.

As regards the functional results—all of these cases have been under observation since operation—one case dating back two years has from 50 to 150 cc. of residual; the remaining 3, that had complete retention, occasionally have from 30 to 100 cc. of residual, but usually empty the bladder; the case having 29 ounces of residual, has emptied the bladder but averages 90 cc. of residual; the 2 cases having 12 and 14 ounces of residual, empty the bladder. All are free from catheter life.

While no contraction of the vesical neck has been noted since operation, an occasional dilatation with a Kohlman dilator to 35 or 40 F. has been carried out, the seminal vesicles emptied and an instillation of mercurochrome given in the bladder. Recently hexylresorcinol has proved beneficial in clearing up the infection.

The occasional small residual has seemed to be due to a certain amount of atony of the bladder wall, the tone, however, improving in all cases as times goes on.

The punch operation as carried out with the Young punch or the cautery punch of Caulk through the urethra without a suprapubic opening is thoroughly satisfactory in the great majority of cases with partial retention due to sclerosis of the vesical neck, constricting bar of the prostate, and the small fibrous prostate.

In these types of obstruction which present in addition, a severe grade of infection of the urinary tract and *large amounts* of residual urine *or complete retention*, without hypertrophy, better functional results will be obtained by preliminary suprapubic drainage, which holds the bladder at rest, allowing a return of muscular tone, a clearing up of the infection, and reduction of congestion of the vesical neck; followed by a punch operation under guidance of a finger in the suprapubic sinus, which permits of a more complete operation, entire control of the bleeding and allows for subsequent drainage, than by an

attempted enucleation of the fibrous ring or bar, the punch operation without drainage, or excision of a posterior section of the ring through a suprapubic opening.

Retention due to supposed hypertrophy of the prostate may be caused by a fibrous ring with engorgement secondary to infection, the true pathology being clear only after complete drainage of the bladder.

OPERATIVE TREATMENT OF UNDILATABLE STRICTURES OF THE URETHRA

ARTHUR H. PAINE

Rochester, New York

A consideration of the pathological anatomy of strictures of the urethra and the process involved in their formation indicates the futility of a permanent result from the classical external urethrotomy and suggests a radical procedure for the nearest approximation to the restoration of a normal canal.

Undilatable strictures of inflammatory origin are the product of the process which has taken place in the structures beneath the mucosa. The catarrhal or ulcerative lesions of the urethral mucosa per se never produce undilatable strictures. When a filiform stricture yields to a long course of gradual intermittent dilatation and cure has been established, the mucosa is intact and serviceable although altered from its original structure. The condition and future serviceability of the mucosa is no different in many undilatable strictures.

All text books give a technique for resection of a stricture bearing area of the urethra. The procedure varies in extent from the method of Cabot whereby the urethra and stricture are incised longitudinally on the ventral surface and closed by a transverse suture line, and the method proposed by Stern where the bulb is freed and elevated and an oval section removed, the urethra being closed by transverse suture, to radical removal of from 1 to 8 cm. of urethra and entire spongy body accompanying it, the repair being made by end to end suture of the proximal and distal ends of the remaining urethra. More recently McGowan has advocated a radical removal of all the strictured urethra together with spongy body and surrounding fibrous nodules. The repair is accomplished by slitting the remaining urethral ends into three ribbands and joining these end to end and laterally.

The mucosa of the urethra is known to have great powers of healing and proliferation which make the repair of such radical procedures successful. This fact furnishes no reason for unnecessary sacrifice of mucosa by wholesale resection of tissue not fundamentally involved in the cause of the condition. Since the true contracting undilatable fibrous tissue lies around and outside the mucosa why cut into the lumen of the canal and sacrifice any of the mucosa if it can be avoided?

I have employed the following technique in 12 cases and been well satisfied with the result.

An inverted U-shaped incision was made exposing the perineal muscles. These were divided to give complete exposure of the bulbocavernosis. This muscle was split its full length at the median insertion and entirely freed and retracted from the bulb. In 2 cases the incision was extended anteriorly in the median raphe of the scrotum to expose a considerable portion of the scrotal urethra. A filiform previously passed through the stricture was attached to a sound of the largest size which would pass to the face of the stricture. If strictures of small caliber were present in the penile urethra obstructing a sound, internal urethrotomy was performed. Careful dissection was then commenced literally along the edge of the spongy body working from each side around the urethra until the sound could be gradually advanced. Great care was employed not to cut into the urethral lumen and to leave the mucosa intact. By thus freeing the urethra from its fibrous envelope and removing the scar tissue the sound ultimately passed into the bladder. This sound was withdrawn and larger ones introduced up to 32 French. If a larger sound became obstructed, further dissection was carried on at the point of obstruction until it was freed and would enter the bladder. Should the mucosa be opened the dissection proceeded simply making an effort to divide the periurethral fibrous sheath and avoid as much damage or excision of mucosa as possible. Small incisions or exisions of areas of mucosa require no repair. A 20 French Robinson catheter was introduced well within the internal sphincter and fastened by adhesive to the glans penis. The perineal structures which were divided were carefully recon-

structed. A small rubber tissue drain was placed at the depth of the dissection.

If the urine is grossly purulent, perineal induration or fistulae are present or there is reason to suspect contracture at the vesicle neck or vesicle calculi a suprapubic cystostomy is performed and intravesicle abnormalities corrected.

If the perineal tissues show edema, induration or other indication of an active inflammatory reaction further operation is deferred until these tissues have recovered.

When the urine is clear or if only very slight infection is present suprapubic drainage is not established. The indwelling catheter insures good drainage and no trouble has been encountered.

About the tenth day the catheter is removed and a sound or bougie is passed to bladder. Every fourth or fifth day thereafter a sound is passed until 30 or 32 French passes easily. The patient is instructed to come to the office or dispensary at increasing intervals for dilatation with Kollman dilator.

In presenting this subject I hope to stimulate urologists to an effort to perfect a rational operative procedure to supplant external perineal urethrotomy and avoid drastic resection of valuable urethral mucosa.

Even though definite areas of urethral mucosa and spongy body are so hopelessly converted into scar tissue that complete resection must be done, a surprisingly large amount of the mucosal tube can be conserved proximal and distal to the resected portion by this method.

DISCUSSION

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): The addition of the cautery element to the punch is a distinct addition to that method. We have been using the cautery punch in selected cases of prostatic obstruction more frequently during the past year and with better results than we did in the past. However, we have been selecting our cases more conservatively, in that where lateral prostatic lobes are present we have not used the punch. It must be said, however, that this method is not without reaction and hemorrhage, nor without danger. Although the hemorrhage is delayed and is not so marked as with the ordinary punch, nevertheless it is occasionally quite severe. Particular care must be used to see that the instrument is in good condition. In one case which we observed the cautery knife was loose, so that in withdrawing the instrument, considerable damage was done to the urethra, resulting in the infection and death of the patient. In a number of other cases we have seen a delayed reaction which was quite severe. We have found that it is advisable in cases of large retention either to establish preliminary catheter drainage or to do a preliminary suprapubic cystotomy. It unquestionably lessens the severity of the reaction in some of these cases.

On the whole, it seems to me that we must acknowledge the value of the cautery punch in cases of medium lobe prostatic obstruction, but where the lateral lobes are also enlarged, I think we should be more conservative than the attitude adopted by Dr. Caulk.

Dr. GEORGE R. LIVERMORE (Memphis): We all unquestionably know that inflammation plays some part in these enlargements because oftentimes where we have a very greatly hypertrophied prostate, after the bladder is drained, we know that that prostate shrinks considerably. The very fact that Dr. Caulk has reported

such a number of cases, and particularly of this man eighty-one years of age, in which there was such a marked hypertrophy and apparently relieved so satisfactory, it seems to me would cause us to investigate this and look into its merits before we condemn it.

In regard to Dr. Paine's paper, some years ago I devised a little operation for the treatment of stricture of the urethra. The paper was read before the American Urological Association, and was very severely criticized for bringing up such a subject. It was stated that external urethrotomy had been relegated to the scrap heap and that it was no longer necessary to be done. In our part of the country, where we have so many negroes, it is one of our most frequent operations in the urological department, and many of these negroes not only have one external urethrotomy, but I have operated as many as three and four times on the same negro, because it is almost impossible to get that negro to come back to the clinic and have dilations; for after he is relieved by his operation, he goes away and stays until he gets complete obstruction again and cannot void. Then we get hold of him and have to do another external urethrotomy.

My operation, instead of sitting down before the patient and with a filiform or a grooved director or a probe and trying to locate the opening through the stricture, which is very difficult, was simply to put the sound down to the face of the stricture, open the urethra at the face of the stricture, lay your finger right against the face of the stricture and make a small incision with a knife. By pushing with your finger, in nine cases out of ten, it will go on into the neck of the bladder, although it is not always successful. There are so many cases in which we have so much scar tissue that rather than keep punching and making false passages, I prefer to do a suprapubic and retrograde catheterization which locates the urethra and prevents unnecessary damage.

Dr. HENRY L. SANFORD (Cleveland): I think these slides bring out two points. In the first place, that these prostatic bars or obstructions may be either congenital or form early in life; and the second is the tremendous effect of back pressure which they have early in life.

This was a man of forty-five who at the age of four had had a large vesical calculus removed. Ever since then he had a pyuria and frequency of urination. He did not come for further treatment until he was forty-five, and then he came on account of hematuria. We naturally thought of a recurrence of the stone, and not finding anything to account for it, we did a cystogram. You see the ureteral catheter in place and the insufficiency of the ureteral vesical valve on the left side. It is also insufficient on the right side, but it does not show as well. We did a functional test and found there was absolutely no secretion from the left kidney. Then we recystoscoped him and found there was a bar there, and the punch operation apparently relieved him completely, because he now has no residual urine, and, strange to say, subsequent functional tests show that that left kidney which did not secrete anything is now secreting a fair amount of dye.

Dr. ALEXANDER RANDALL (Philadelphia): I am in the habit each year just before lecturing of reading a very interestingly titled article by Dr. Keyes on "The mechanism of urinary obstruction." I think each year I have laid it down wondering what Dr. Keyes meant and what his argument was. It is most alluring, but I think a great deal of this subject is wrapped up in the fact that we do not very thoroughly, if at all, understand the mechanism of the vesical orifice.

If I may, I should like to show you some slides of the pathology as it has been found by me at autopsy and draw attention to one or two anatomical facts which we must have under consideration when we are trying to interpret clinical findings in the absence of the recognition of the actual pathology that goes on. First, I want to take exception to Dr. Caulk's remark of this condition being an inflammation. I think if he substitutes the word congestion for inflammation he will be much further along his route.

[Slide.] Now, there is such a thing as a true fibrous bar. This is possibly a poor example of it, but it is the best I have seen, and it is nothing more than a fibrotic lip elevated from the normal uvula to an obstructive position at the vesical orifice.

This second specimen gives you what is more frequently seen on cystoscopy in the ordinary straight fibrous bar cases. This case, by the way, has a diverticulum. It brings out one pathognomonic feature which you can find for diagnosis when you cystoscope your patient, and that is the contracture has drawn the verumontanum from its normal position an inch below the lip up to and right underneath the actual lip of the bladder.

As you withdraw your cystoscope you drop into a deep pocket, and at the bottom of this declivity one finds the verumontanum drawn up by the sclerotic process.

The next thing to be proved is whether or not that bar which is then present is obstructive.

[Slide.] On section, this is your picture. Your lip is made of fibrous tissue. It is a sclerosis. That is the pathological material. It is a contraction. That is a clinical term. I think we would do well if we were to agree today to call these conditions under one certain name. I use the term "bar" simply because Guthrie first used that term in 1832 and gave as good a description as we need today.

[Slide.] There is a little bit thicker type of fibrous bar, and from this you go on so that at some time, with a specimen in your hand, you can not for the life of you tell when you have passed from the fibrous type into a type which I have termed the glandular bar.

[Slide.] That again is a little bit thicker, a little denser type of tissue.

[Slide.] Here is still heavier tissue. Cystoscopically instead of getting a sharp edge you get a more rounded edge.

[Slide.] And if you section the true glandular bar, you will find that the posterior glandular commissure which connects the right and left lateral lobes passing under the vesical orifice and in front of the ejaculatory ducts has undergone hypertrophy and you find the "bar" formed of definite glandular tissue.

[Slide.] Now, that is not a fibrous bar. That is a glandular bar, but I must tell you that they are extremely difficult to differentiate clinically.

Again, the glandular bars grade over to a third type of obstruc-

tion occurring at the vesical orifice, where the obstructive tissue is found to arise from the subcervical glands (Albarran's glands) which as you know, lie submucous and extra-capsular and not a part of the posterior commissure. If you section one of these localized subcervical glandular hypertrophies you will find just under the mucous membrane a spheroid of true adenoma, exactly the same as you find in the hypertrophied lateral lobes where you so frequently have seen a group of spheroidal adenomas, and your posterior commissure will be found lying deep down under it and not showing any hypertrophic change; a purely submucuos adenoma.

[Slide.] That is a section of a specimen showing where these subcervical ducts open, this course lying submucous, then their glands under the vesical lip, and the posterior prostatic commissure deep under this overlying tissue and incapsulated with the prostatic lateral lobes. When Albarran's glands get larger, they get pedunculated, and they never go on to form a definite bar.

[Slide.] Here is a little pedunculated one, looked at suprapubicly, a beautiful ball-valve, obstructing the orifice. They will go on until they get to be large pedunculated lobes, and that pedunculation is the one characteristic of that type of hypertrophy.

[Slide.] The horse collar type Dr. Caulk has described, which to my mind is a very rare type of hypertrophy.

One other anatomic fact which we must bear in mind, too, is the lack of knowledge of the function of the internal sphincter and the vesical lip. We have seen almost this same clinical picture of dysuria, with residual urine in the female. In such we can certainly rule out hypertrophy of glandular tissue. We can certainly rule out underlying chronic infection, and I think Dr. Caulk reported a case where he had actually done the punch operation on such a patient. The question I would raise, is how much of the inprovement, following certain punch operations, may be due to destruction of hypersensitive mucous membrane especially at the trigonal apex, a spot which we know to be excessively tender and easily irritated. In the past we have

seen such cases treated and cured by silver nitrate application, by fulguration, by sphincterotomy and even by persistent sounding.

I believe aside from the pathology, we have got to think also of normal anatomy and normal physiology, and I often wonder if some good results are not obtained by the destruction of sensitive areas as much as by the actual removal of obstructive tissue.

Dr. RICHARD F. O'NEIL (Boston): I would like to ask Dr. Caulk what his experience has been with preliminary superpubic drainage and palpation of the internal vesical orifice before applying his instrument. I have had occasion to follow this method a few times before using Dr. Young's punch, and it seemed to me to be a very satisfactory procedure.

Dr. CHARLES H. CHETWOOD (New York): In conclusion, I would stress the importance of the simplified classification, not only because it is impossible to know the nature of the pathology of these cases from our preliminary examination, but also for the benefit of the patients themselves. We, most of us, have wandering patients sometimes, and sometimes they wander back again. One of my patients who was given to understand his condition as that of some sort of obstruction at the neck of the bladder which was described as in the nature of prostatic hypertrophy, wandered; and then he came back to me in great glee stating that the real nature of his trouble had been discovered, he had accessory glands. I did not know why he was so elated over it except that he had been given to understand that they were more "accessible."

The advantage to my mind of the open operation is the importance of preliminary drainage, and I do not know of any simpler operation, under the present latest methods of local anesthesia than cystotomy, to which is added the benefit of direct contact which is sometimes enormous and brings to light the real lesion as it exists. The method of attacking it can then be determined upon with much greater satisfaction, be that an excision or an incision.

We owe a debt of gratitude to Dr. Caulk for introducing and popularizing the added feature to the punch operation of galvano cauterization through his method, and I take this opportunity of concurring with him entirely.

Dr. JOHN R. CAULK (St. Louis): I do not wish to be misinterpreted about the hypertrophies. I made it plain that the large hypertrophies were definitely surgical. I have utilized this method simply to determine or prove to myself that the pathological change is a hyperplasia, of inflammatory origin and not an adenoma. Most of the pathologists agree to that. Ewing gives it a definite inflammatory origin. If the process shrinks under partial resection or under suprapubic or catheter drainage, it could not be an adenoma. This reduction is not only congestion but disappearance of definitely solid tissue. That is the chief feature of the paper that I presented. There is no question about the fact that there is such a difference between the anatomical bladder neck and the physiological one.

Dr. Randall says the collar necks are very rare. My experience is that they are the most frequent. Probably when he sees the specimens at autopsy there has been disappearance of surrounding reaction, but when I see it cystoscopically, I see a complete rim around that orifice. My idea is that the bar probably is the foundation but the rest of the business is reactionary, and I agree with Dr. Chetwood that many of these things, far more than 14 or 15 per cent, are contractures originally, and that there is a super-imposed inflammatory process of certain degrees or gradations, some of them amounting to pseudo-hypertrophies, you might call them, which fool you.

Under catheter drainage and incision through the orifice, you get practically the same release of tension. If one does a suprapubic drainage, he has done rather a job, and I see no reason then to do a punch. Under catheter drainage and incisions through that orifice, you will find the most astounding transformations in that bladder picture, and pretty promptly. I have been deceived, and for that reason I have gradually used this operation more and more for these apparently large obstructions.

The one patient whom I cited to you had an enormous hypertrophy, and I just gave him as an illustrative case because of the fact that even such a gross enlargement went down under partial removement, showing to me conclusively that it is bound to be inflammation and not neoplasm.

Dr. HUGH H. YOUNG (Baltimore): In looking over our records recently, we have found many cases in which there was not only contracture and bar posteriorly but also a bar or valve-like mass anteriorly. In such cases I make a cut anteriorly and remove the anterior portion of the prostate as well as the posterior.

I think it also is very difficult to differentiate inflammatory thickening and adenoma posteriorly if it forms a rounded mass. Our experience is that when an adenoma of the median lobe is present the punch operation is usually not successful because it is usually associated with a lateral hypertrophy. In my early enthusiasm about the operation, I "punched" a good many such cases and in quite a number I had to do a prostatectomy afterwards. I am a little more conservative than Dr. Caulk is at present in attacking these slight hypertrophies, but I wish to congratulate him on his evidently fine statistics. No doubt he has accomplished a lot with his cautery punch.

SARCOMA OF THE PROSTATE

HARRY CULVER

Chicago, Illinois

Received for publication June 15, 1925

Judging from the reported instances of primary sarcoma of the prostate, it is a very uncommon condition. In 1917 Parmenter (1) collected 59 authentic cases from the literature, and I am now adding 15 more, making a total of 74 cases, including the one herein described.

The ages of the individuals ranged from eight months to seventy-seven years at the time the diagnosis was made. This occurred in 23 patients or 31 per cent before the tenth year of life, in 33 patients or 44 per cent before the twentieth year and in 56 patients or 75 per cent before the fiftieth year. It is therefore apparent that it is a condition most common in the very young and adolescent, but may occur in any decade of life.

Gruber and Maier's (2) and likewise Newman's (3) patient had both sustained severe perineal injuries just before the onset of symptoms which results in the diagnosis of prostatic sarcoma. They contended that trauma merely hastened the progress of the previously existing sarcoma.

These tumors have developed upward toward the bladder and downward toward the rectum, and most frequently protruded in both directions, at the same time encroaching upon the lumen of the prostatic urethra at different points causing obstruction and tortuosity of this channel. They tended to be lobulated, covered by a thin smooth sheath which is continuous with fibrous bands which traverse the substance of the neoplasm. Papillomatous forms have developed where the capsule has been eroded or rup-

tured. The entire prostate has been invaded as a rule, but certain lobes may be particularly involved.

Direct extension has taken place into the bladder, rectum, prerectal, retroperitoneal tissues and even the adjacent pelvic bones. Metastases have been relatively rare, considering the large size and rapid progress of the primary growth, but the lungs, pleuro, liver, pancreas, bones, kidneys and lymph nodes have been invaded. The blood stream has been the route generally considered responsible for most metastases, nevertheless there are recorded instances of undoubted lymph-stream invasion, namely that of Taschiro (4) whose patient 60 years of age presented a gross clinical picture of leukaemia or pseudoleukaemia characterized by great splenomegaly and numerous swollen lymph glands. The primary tumor was found to be in the prostate at necropsy, with metastases in lymph nodes, spleen, liver and bone marrow. He added that the absence of a tendency to secondary hematogenous metastases in the prostate and the large size of the prostatic tumor indicated sufficiently clearly that the primary tumor originated in the prostate; although it had produced no local symptoms. Lymph stream invasion has not been the rule, however, and practically never occurs in children.

Eleven types of sarcomas have been described in this connection, the round cell type was the most frequent with 24 and the spindle cell second with 16 instances. There were 8 myxosarcomas, 5 lymphosarcomas, 4 rhabomyosarcomas, 3 angiosarcomas 6 diagnosed as sarcoma and 8 of miscellaneous types.

Symptoms, when present, were those associated with vesical or rectal obstruction. The first symptom in the young has frequently been acute urinary retention, this was sometimes preceeded for a few days or weeks by frequency and burning on urination associated with dysuria. In adults the progress of the disease was less rapid and the symptoms likewise were more gradually developed and simulated those associated with adenoma with or without infection. Intestinal disturbances was the first complaint with some patients, usually started as a gradually increasing constipation, frequently alternated with diarrhea and associated with cramp like pains along the course of the colon.

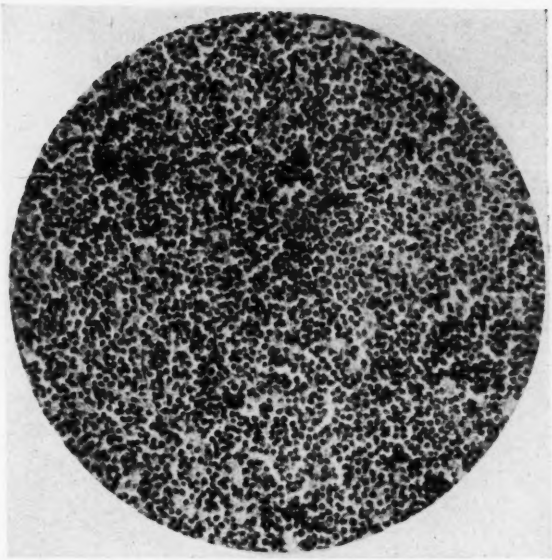

FIG. 1. MAGNIFICATION OF 170 DIAMETERS, THROUGH THE MOST CELLULAR PORTION OF THE TUMOR

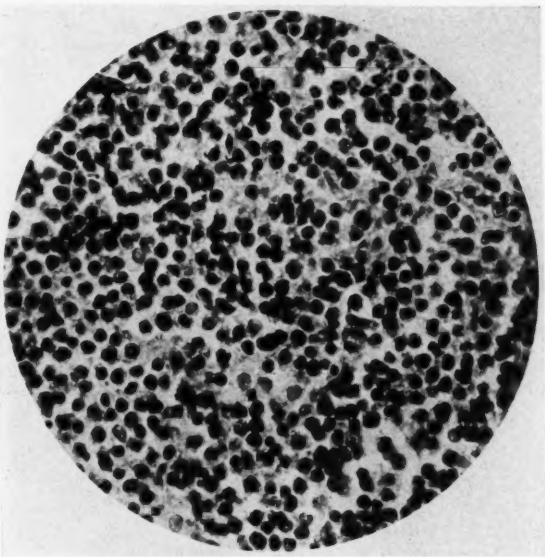

FIG. 2. MAGNIFICATION OF 400 DIAMETERS, SAME AREA AS FIGURE 1

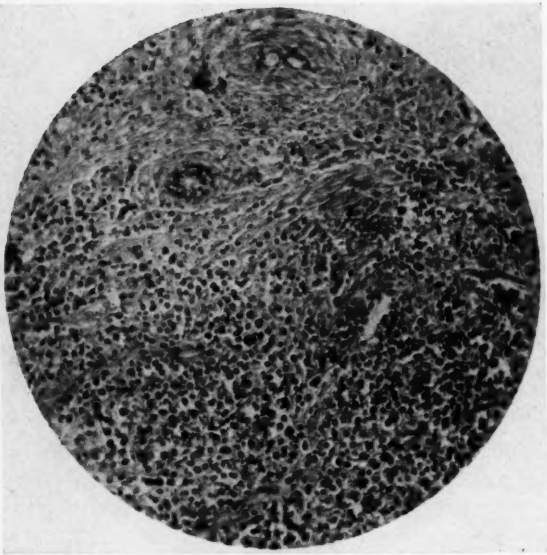

FIG. 3. MAGNIFICATION OF 140 DIAMETERS, SHOWING GLANDULAR AND FIBRO-MUSCULAR TISSUE, TOGETHER WITH THE LARGE ROUND CELLS

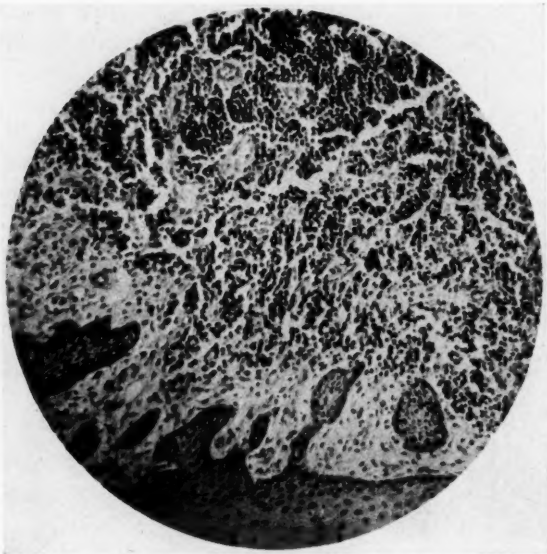

FIG. 4. MAGNIFICATION OF 140 DIAMETERS, SHOWING METASTATIC TISSUE APPEARING FROM THE SOCKET OF THE EXTRACTED TOOTH

Both vesical and rectal obstructions were present in the same individual in many instances.

Hematuria has not been a common finding excepting that produced by instrumentation, while pain, other than that associated with vesical or rectal obstruction was limited to a few instances of perineal discomfort.

The diagnosis in the young was suggested by a rapidly developing urinary retention with or without symptoms of intestinal stasis with the finding rectally of a soft, smooth, balloon like mass which completely replaced the prostate, while in those patients of the age where adenoma or carcinoma might have been present the diagnosis has been much more uncertain. The rectal findings varied from a quite firm mass to that of a soft doughy consistency which has been confused with fluctuation resulting in several prostates being drained perineally to be followed soon by rapid extension of sarcoma along the wound. The disturbances, both urinary and intestinal, were much less in older individuals, the tumors relatively much smaller and the progress of the disease less rapid. Loss of weight was progressive.

It is of interest to note that in Quimby's (5) patient, having a lymphosarcoma of the prostate, the rectal examination was normal and the symptoms were those of vesical obstruction and infection. Stern and Ritter's (6) patient, forty-five years old, had had urinary disturbances for two years.

The tumors have been confused with adenoma, carcinoma, syphilis, tuberculosis, abscess and echinococcus cyst, and must be differentiated from them by history, local and general physical findings, together with the serological reactions. Excepting in the very young the differential diagnosis may often be incomplete as many of the diagnoses were made at operation or even after microscopic section of the tissues.

The results of treatment were uniformally unsuccessful, the patient living longest after the diagnosis was that of McGowan (7) who died four years later of primary carcinoma of the liver.

Regardless of the management, which has usually been enucleation, either suprapubic or perineal, death has resulted generally in a few months with local recurrence and ascending urinary infection.

CASE REPORT

Polish boy, twelve years old, admitted to The Cook County Hospital, Chicago, December 20, 1924, with acute urinary retention.

At the age of four years he acquired tuberculosis of the right hip joint. Six years of orthopedic managment resulted in closure of all sinuses and bony ankylosis of the joint.

December 1, 1924 he presented himself to a dental infimary where a lower left first molar was extracted because it was painful and loose. A dental examination ten days later revealed a red cauliflower-like mass, 2 cm. in diameter, growing from the socket of the extracted tooth. On December 16 this mass was excised and the socket thoroughly curretted at the Oral Surgical Clinic of the University of Illinois.

His urinary disturbance was of two weeks duration, beginning just after the extraction of the tooth. He first noticed suprapubic pain at the beginning of urination, which was soon associated with increasing frequency and difficulty of urination. Two days of this and complete urinary retention developed which was permanent.

There was no pain or discomfort of any sort excepting due to a distended bladder. No hematuria was noted and there were no gastrointestinal disturbances, defecation was normal.

Physical findings revealed a well nourished boy not acutely ill. There was pelvic deformity and some shortening of the right leg. No spondylitis was noted clinically or by the roentgen ray. The lungs were clinically normal but glandular shadows were demonstrated at the right hilus by the roentgen ray. Rectal examination revealed a large smooth moderately soft mass replacing the prostate. No nodular areas were felt, but the mass was not of the same consistency over is entire posterior surface, there being small isolated areas definitely softer than the remainder of the growth. The right seminal vesicle was palpable and nodular, being much firmer than any part of the prostatic mass.

All external genitalia were normal, and there was no demonstrable adenopathy. The Wassermann reactions of the blood and spinal fluid were negative.

The blood picture was that of a mild secondary anemia.

Cystoscopic examination. General anesthesia, December 26. There was marked difficulty in passing a No. 18 F. cystoscope, due, in part, to marked tortuosity of the posterior urethra. To pass the vesical neck it was necessary to greatly lower the shaft of the instrument.

The bladder walls showed only moderate increased vascularity.

The trigone was greatly elevated, which elevation was continuous with an intravesical protrusion on the lower two-thirds of the right vesical neck. The mucosa of the trigone and vesical neck was everywhere intact, light in color and showed no inflammatory changes.

The history of chronic tuberculosis elsewhere in the body together with the nodular right seminal vesicle suggested genital tuberculosis, although the prostatic findings rectally were not in accord with the usual findings in this condition. Dr. F. M. Phifer mentioned a prostatic tumor as a possibility, basing his opinion especially on the rapid progress of the condition and the balloon-like soft mass felt rectally.

Following the cystoscopic examination it was very difficult to catheterize the boy and a cystotomy was therefore done. The bladder walls were normal in appearance. A smooth intravesical mass extended from the elevated trigone and floor of the vesical neck up the right lateral border. The entire prostatic urethra was surrounded by this mass which in places had almost completely blocked the channel. It was apparent that we were dealing with a neoplasm. It enucleated readily in fair sized pieces, being very friable, pale gray and glistening. Certain close fibrous attachments prevented the removal of all portions of the growth, there remaining many isolated tags of tumor tissue adherent to the capsule, the subtrigonal mass was likewise incompletely removed. Bleeding was not great and readily controlled by a pack.

The post-operative course was satisfactory, however there was evidence of pyelonephritis from the beginning. On the twelfth post-operative day he developed findings of broncho-pneumonia. He died on the twenty-second post-operative day, with marked local recurrence as determined by rectal examination, clinical findings of acute pyelonephritis and terminal broncho-pneumonia.

The suprapubic incision presented no evidence of recurrence, but there was no tendency toward healing.

No necropsy was permitted.

Microscopic examination by Dr. Harry Singer: In several sections taken from the material removed at operation there is seen large masses of round cells having no organoid structure. The individual cells are closely packed, for the most part unassociated with a demonstrable intercellular stroma. Morphologically the neoplastic cells are uniformly round corresponding roughly in size to that of large lymphocytes. The cells consist mainly of nuclear material in connection with which only a fine cytoplasmic rim can be found. Varia-

tion in size and form are not prominent features, although rapid proliferation is reflected by the hyperchromatism, numerous mitotic figures, and the high grade cellularity of the growth. The blood vessels in the section for the most part have very thin walls but hemorrhage is not a conspicuous feature. In an area of one of these sections were apparently degenerative processes have occurred evidenced by the presence of hyalinized fibro-muscular tissue, acinous elements presumably prostatic or urethral are identified. Several areas manifesting retrogressive changes are found in various regions.

Diagnosis. Morphological—large round cell sarcoma. Histogenetic—undetermined.

The sections from the mass removed from the jaw show the same type of neoplasm.

While it is apparent that this condition is beyond surgical relief when symptoms appear, especially in the young, it seems advisable to suggest conservative management, such as cystotomy, to be followed by some form of irradiation.

In the case here in reported I am satisfied that death was hastened by the radical surgical procedure.

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A CASE OF PROSTATIC TUBERCULOSIS WITHOUT DISCOVERABLE LESIONS IN KIDNEYS OR EPIDIDYMES

EDWARD L. KEYES

New York

Received for publication June 15, 1925

CASE HISTORY

W. F. (9463), thirty-eight years of age, consulted me March 2, 1920, with the following pertinent history:

No previous history of tuberculosis.

At about the age of eighteen, prolonged, mild gonorrhea, during which he does not remember having suffered any pain.

Five years later (1905) a number of months of abdominal symptoms relieved by removal of the appendix. Thereafter for several weeks, the urination was somewhat frequent and uncomfortable by day only. He never passed a stone and no pus or blood were ever found in the urine. There mild urinary symptoms recurred in the fall of 1908; and again in March, 1919 (following an infection termed "influenza") he had bladder irritation and occasional mild pains in the genitals and thighs. These symptoms were attributed by a competent urologist to prostatitis and were relieved by instillations and prostatic massage.

He was well from June 15 to September 15, 1919; then the symptoms recurred and treatment by the physician who had previously relieved him only made him worse.

When he came to me the following March, he usually arose once at night to urinate, considered his urinary intervals normal by day, and had a good deal of pain at the end of penis, especially toward the end of the day, this pain not related to the act of urination but made worse by sexual intercourse.

Physical examination. Height, 5 feet 11 inches. Weight 155 pounds.

General physical examination negative.

Rectal examination revealed a hard induration on the right side of

the prostate and slight irregularities due to scarring over the left lobe. Vesicles slightly scarred but not dilated.

The prostatic secretion was purulent and contained acid-fast bacilli in groups, alcohol fast over night.

The urine was hazy with pus and contained acid fast bacilli morphologically resembling tubercle bacilli, as had those in the prostatic secretion.

The epididymes were entirely free from induration.

The urine was found to contain pus, albumin, red blood cells, no casts, no sugar. Specific gravity, 1020; urea, 9 grams to the litre.

Subsequent history. Diagnosis of tuberculosis of the prostate without tuberculosis of the kidney or epididymis was made.

A few attempts at local treatment only made him worse. He was sent to Colorado Springs, where x-rays showed shadows suggesting tuberculosis at the apex of the right lung, and at one time a few râles were heard there. He remained in Colorado and New Mexico most of the time for the next two years, his discomfort varying, but on the whole growing worse.

In the spring of 1923 he visited New York, reporting that a guinea pig had died of tuberculosis after injection with his urine; but that no acid-fast bacilli had ever been found in the urine after my examination in 1921, though they had been repeatedly searched for.

The second urine passed was still clear, yet it seemed wise to chance a cystoscopy. This revealed no pus from either kidney.

Intravenous phenolsulphonephthalein gave a return of 45 per cent in the first half hour; 25 per cent in the second.

The specific gravity of the urine was usually about 1020; there was always a faint trace of albumin.

At about this time he began to have left renal colics, and these increased in severity to such an extent that on one occasion I found him writhing upon the floor, gave him two injections of $\frac{1}{4}$ grain of morphine, and then left him to the care of a hotel physician, who reduced him to unconsciousness with more morphine before he relieved his pain.

He then entered the hospital, on December 14, 1923. I urethroscoped him and found a few granulations about the base of the verumontanum, and a bladder neck so tight that the urethroscope could not be introduced into the bladder. No superficial lesion was seen suggesting tuberculosis. X-ray of the urinary organs showed nothing abnormal, but the urinations had become much more frequent; every hour by day, three times at night. The urine was purulent in both flows. There were about 125 cc. of residual urine.

The repeated negative examinations for tubercle bacilli and the indefinite findings by urethroscopy led me to hope that after all he was suffering merely from a prostatic sclerosis not due to tuberculosis.

FIG. 1. TUBERCULOSIS OF PROSTATE

I cystoscoped him again and found a few nondescript, small, superficial erosions just above the urethral orifice, and a tight bladder neck.

With the concurrence of Dr. Edwin Beer, I therefore, on January 15, 1924, did a suprapubic cystotomy for sclerosis of the prostate, excising with a Rongeur forceps a large piece of the lower portion of the bladder neck, and enucleating a slightly enlarged sclerotic right lobe of the prostate. The specimens obtained showed typical tubercles. (Fig. 1.)

The convalescence was uneventful excepting that the suprapubic wound granulated and did not heal, until six weeks after operation he was submitted to ultra-violet light, after which, healing proceeded and the fistula closed at the end of the third month. During this healing a mass of these granulations were cut away. Microscopically, the examination of these revealed no tuberculosis, and an emulsion from them was injected into a guinea pig without causing tuberculosis, possibly because the bacilli had been killed by the light.

He went west again and returned in December, 1924, stating that he now could hold his urine all night, as a rule. The urine still showed a specific gravity above 1020; contained the same trace of albumin; no casts; and was hazy with pus, containing clumps and chains of cocci.

When last seen in April, 1925, more then a year after his operation, he declares himself cured, in that his urination is normal; his penile and perineal pain relieved; his general condition satisfactory; his renal colics have not recurred since operation.

The urine still contains a trace of albumin, pus cells and streptococci.

There has never been any evidence of renal tuberculosis.

The epididymes have never been implicated.

The semen shows many normal spermatazoa.

COMMENT

This patient gives a history characteristic of sclerosis of the prostate and extending for twenty years (preceded by a gonorrhea).

The evidences of tuberculosis are the finding of tubercle bacilli in the urine and in the prostatic secretion; the infection with tuberculosis of a guinea pig injected with his urine; the pathological appearances of the tissue removed at operation; the three months required to heal the suprapubic wound; and its rapid improvement under ultra-violet ray. The striking discrepancy is the absence of other lesions in the genito-urinary organs.

DISCUSSION

Dr. HERMAN L. KRETSCHMER (Chicago): The question of the diagnosis of sarcoma of the prostate in Dr. Culver's case interested me very much, as I had the opportunity of making a pre-operative diagnosis of sarcoma of the prostate in a young man of thirty-one whose duration of symptoms had been present for only three weeks before he came under observation.

Briefly, he complained of slowing of the urinary stream, a lack of force, great frequency and urgency of urination, and acute retention, so that it was necessary to catheterize him before he came under observation. The complete physical examination and x-ray examination for evidence of metastases, such as Dr. Culver found, were negative. Rectal examination showed an enormous enlargement of the prostate which extended to the bony pelvis on either side and up much higher than I could reach with my finger. The striking thing about the rectal finding was the fact that this mass had a doughy, semi-fluctuating sort of consistency. In considering the diagnosis, it was perfectly obvious that this large mass could not be a carcinoma of his prostate, that it could not be a simple benign hypertrophy, and that our differentiation concerned itself chiefly with three things: First, abscess; second, with echinococcus disease, and third, with sarcoma. Abscess of the prostate we ruled out because of the enormous size and consistency of the prostate by a normal leucocyte count and a normal temperature. Echinococcus was ruled out by a negative complement fixation test and by the absence of eosinophilia in his blood. So we made a diagnosis of sarcoma of the prostate by exclusion.

The patient disappeared from observation and was operated upon in Michigan. The patient's physician was kind enough to send over some microphotographs, and also the report of the pathologist who made a diagnosis of sarcoma.

In reference to Dr. Keyes' patient, I should like to ask Dr.

Keyes whether or not he catheterized the ureters in his patient only once.

Dr. KEYES: Yes.

Dr. KRETSCHMER: And on that you excluded any kidney lesion? How did you explain his severe renal colic which was so severe that the man was knocked down! He evidently had some serious renal lesion.

Dr. KEYES: I do not know. I have seen that happen with sclerosed bladder necks once or twice.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): One of the most difficult problems in urologic diagnosis is that involved in the recognition of renal tuberculosis. Whereas it is true that the prostate in the case that Dr. Keyes reported was probably the only organ involved, it is questionable whether any definite statement can be made in regard to the existence of tuberculosis in kidneys unless a guinea-pig inoculation is made with urine obtained directly from either kidney. Time and time again we have observed renal tuberculosis existing without a pus cell in the urine and with perfectly normal function. Even a pyelogram would possibly show but very slight evidence of deformity seen with tuberculosis. Not only one guinea pig but possibly two or three are necessary in order to determine the lesion. Furthermore, it is surprising when we finally do find evidence of tuberculosis how large a lesion of the kidney is found at operation. More and more am I convinced of the fact that tuberculosis in the genitalia is usually secondary to tuberculosis in the kidneys.

Dr. DAVID W. MACKENZIE (Montreal): A brief report of a case we had some years ago—I think it was in 1914 or 1915, of a colored adult, a healthy, large, well developed man who came to the hospital complaining of some slight urinary symptoms. The urine was normal on several examinations. The prostatic examination, per rectum, showed a suggestion of a

wedge in the prostate. With the cystoscope in the urethra, you could still feel this slight thickening between the instrument and the rectal finger. The diagnosis, was made of growth of the prostate. A Young radical perineal prostatectomy was performed. The specimen was sent to the laboratory and was reported tuberculosis of the prostate. The lesion was confined to the prostatic lobe posterior to the ejaculatory duct. The perineal wound was somewhat slow in healing. As far as I have followed him, about three years, he developed no symptoms in his epididymi or in the kidney.

At the same time I want to agree with Dr. Braasch, that I am growing more and more to think that genito-urinary tuberculosis starts in the kidney. The interesting thing in this particular case was that the lesion should have been posterior to the ejaculatory duct, where we expect to find many of our early malignant growths.

Dr. GILBERT J. THOMAS (Minneapolis): I am very much interested in Dr. Keyes' paper. At the present time at The University of Minnesota, the Department of Urology is investigating urinary tuberculosis at the Glen Lake Sanatorium, where we have 500 to 600 patients with tuberculosis of all kinds. It has been our experience that a patient may have tuberculosis of the kidney and a smear made from the catheterized urine may not show tubercle bacilli. We have found it necessary to repeatedly inject urine into a guinea pig before a diagnosis can be made. In a few instances we have demonstrated tuberculosis of the kidney when only one or two pus cells could be found in the catheterized urine. In many instances we have been able to make a diagnosis of renal tuberculosis with the pyelogram before the guinea-pig test could be completed. In these instances we have found very small cortical abscesses which are typical of these infections.

I think this is one of the most interesting conditions that we have in urology at the present time, the diagnosis of the early lesions of renal tuberculosis. In discussing Dr. Barney's paper tomorrow, I hope to show a slide of a very early lesion in one

kidney, so early that we did not find it when we made the pyelogram and did not know it was there until we had the report from the guinea-pig inoculation.

Dr. HUGH H. YOUNG (Baltimore): Dr. Culver's paper has interested me very much. I would like to ask him one question. In his examination, either at operation or autopsy, was the prostate involved? I remember particularly the first case I operated on on mistaken diagnosis of huge hypertrophy, I found when I got in that, the prostate itself was not enlarged at all, but that there was a sarcoma above the prostate which projected far upward and in the lower end of which the prostate lay.

Since then we have had, I think, 4 cases, and as a result we believe that generally the lesion is not a sarcoma of the prostate itself but generally of the cellular tissues beneath the base of the bladder and adjacent to the upper part of the prostate, and that the prostate is not itself enlarged, although often invaded.

We have had 2 cases where we have gotten extraordinarily good results with radium introduced by rectum and in urethra and with addition of x-ray.

I agree with Dr. Keyes that his case is not of primary tuberculosis of the prostate which is certainly not so rare. Guyon many years ago reported a series of autopsies in children where the only lesion was in the prostate. This has been confirmed by reports in the literature from time to time.

We have quite a series of cases where the disease was either in the prostate or seminal vesicles with no lesions in the epididymes or kidneys. The prostate and seminal vesicles are not infrequently the primary source of a tuberculosis which has invaded the kidneys secondarily, often with very few symptoms below, and the first thing to appear is the renal pain and hematuria.

We have recently had 3 cases of primary tuberculosis of the prostate. One of them was a case similar to the one mentioned by Dr. MacKenzie in which I had made a diagnosis of carcinoma and carried out a radical operation. I was much amazed when the specimen removed showed on section that there was no carcinoma, at all, present, but tuberculosis. The patient died and at autopsy we found that there was no tuberculosis elsewhere.

We have recently had 2 other cases in which there was a definite hypertrophy of the prostate present. At operation large lateral and median lobes were enucleated, but on examination of the specimen we were amazed to find tuberculous areas in the tissue removed.

Dr. Shaw has reported a very interesting case, too, in which he found the same conditions, so that I feel that tuberculosis primary in the prostate, and not even involving the vesicles is not by any means as uncommon as we think. I agree with Dr. Braasch that the kidneys must be eliminated and that in all cases of urogenital tuberculosis, ureter catheterization should be done and a guinea-pig inoculation made and studied very carefully with idea of detecting early tuberculosis. In about 30 per cent of the cases in which we have done our radical operation for seminal tuberculosis we have also had to remove one kidney.

I think we must also realize that tuberculosis of the prostate and seminal vesicles is far more common as a primary lesion than we have been led to believe from the literature. I think a good many cases of supposed chronic prostatitis are really tuberculosis which we do not recognize.

Dr. JOHN H. CUNNINGHAM (Boston): This subject has interested me for a long time. We have been fortunate in getting 35 autopsies on patients dying with genital tuberculosis and in only 9 instances have the kidneys been free from the disease. Of these 35 cases 16 had bladder involvement, and 11 of those 16 cases had unilateral renal tuberculosis and 5 bilateral. There were only 9 in which the kidney was not involved.

Many of these cases did not die of tuberculosis.

Dr. Young raises the point that these figures are post-mortem determinations. As a matter of fact, I think we must all recognize the feature of clinical error in establishing, without question, the matter of renal tuberculosis, and that post-mortem examination is the only means we have of absolutely proving the matter under consideration. In this series of 35 post-mortem examinations, no instance can be considered a terminal tubercular

infection, as the renal lesions were old and, as a matter of fact, several of the patients died of other diseases than tuberculosis.

Dr. J. D. BARNEY (Boston): I think it was three years ago at this meeting that I reported a case of primary tuberculosis of the prostate which was grafted on to an adenoma. I had operated on this patient presumably for adenoma of the prostate and was surprised when the pathologist told me that there was not only adenoma but tuberculosis. I have seen the patient and heard from him at intervals since then. He is perfectly free from bladder symptoms and also has a clear, sparkling urine in which I am unable to find any tubercle bacilli. It does seem as if primary tuberculosis of the prostate had occurred at least in that case.

While I am not prepared to take Dr. Young's point of view, it does seem to me that this case of mine was one of this type.

I agree with Dr. Braasch, as I shall try to point out tomorrow in my paper, as to the extreme difficulty of making a diagnosis in early cases and sometimes later cases of renal tuberculosis. A great many of these prostatic infections do arise from a tuberculous kidney.

Dr. B. S. BARRINGER (New York): We have had some 6 or 8 cases of sarcoma of the prostate, and 2 of those are under control respectively about two years and six years.

The first of those cases was a young man who came in with a supra-pubic tumor about three fingers' breadth above the symphysis, a very large prostate, and no retention of urine, bearing our Dr. Young's contention. We did not get a specimen in that case, but there was no reasonable doubt in my mind that he had a sarcoma of the prostate, especially as he reacted to x-ray. He had but one dose of deep x-ray therapy, and no operation. The tumor went down and has stayed down now for about two years.

The second case was a case which had been operated on before I saw him, and a small gland taken out of the edge of the trigone. He had a supra-pubic sinus which I opened up and saw a sloughy mass 2 by 2 cm. A specimen was obtained, and we planted radium in it. Dr. Ewing's diagnosis was sarcoma of the prostate

of low degree of malignancy. He was subsequently radiated per prostate quite a number of times. He reacted to radium more as a carcinoma reacts than a sarcoma. He is well six years today.

I want to agree entirely with Dr. Young and Dr. Culver that the thing to do in these cases is not to operate, to make the diagnosis if possible before operation, and keep your knife off the patient, because these cellular tumors react very extraordinary to radium or x-ray therapy (which is possibly better than radium) and they should be so treated.

Dr. J. A. C. Colston (Baltimore): I was very much interested in Dr. Culver's paper. We have made a purely clinical diagnosis in 3 cases of sarcoma. All these cases had enormous enlargements of the prostate, an enormous retroperitoneal mass which extended back of the bladder, and a clinical diagnosis was made in every case, and in no case did we obtain a microscopic section.

In all of these cases, we felt the importance of avoiding operation, and they were all treated by simultaneous courses of radium and deep x-ray therapy. In 1 case, the mass disappeared under one course of about 2500 mgm. hours, together with a simultaneous course of deep x-ray treatment. He came back and was seen in six months with a prostate very little larger than normal and typical findings of a chronic prostatitis. We gave him another course of treatment, more as a prophylactic measure than anything else, and I saw him about three years afterwards, and he had practically a normal prostate which showed simply moderate induration. Of course no section was obtained in this case, but the patient was seen by Dr. Young and Dr. Geraghty, Dr. Frontz and myself, and we all concurred in the diagnosis of sarcoma.

In another case, there were somewhat similar findings of an extensive mass involving the prostate and extending upwards behind the bladder. This patient was given entirely similar treatment. The mass shrank up considerably but metastases were present in the lungs at this time. In spite of that, this patient lived for slightly over a year in fair degree of comfort, and I think was prevented from developing any urinary obstruction.

I think these 2 cases bear out what Dr. Barringer and what Dr. Culver have said about the necessity of treating these cases by deep x-ray and radium therapy.

In regard to Dr. Keyes' paper, I had an interesting case just recently which I think bears out the hematogenous idea of infection in tuberculosis of the epididymis. I had a patient with a marked epididymitis on the right side and with a tremendously swollen right seminal vesicle. The left epididymis was quite normal. I did an orchidectomy on the right side and a bilateral seminal vesiculectomy in spite of the fact that the left vesicle was not involved. The left was ligated in the perineal incision for the purpose of preventing any infection of the left epididymis which so often happens in these extensive genito-urinary tuberculoses. Following operation, he did splendidly. He had no urinary fistula and left the hospital within three weeks. He went home, but about two months afterwards developed an acute left epididymitis which I have just removed.

This shows a perfectly normal vas above the epididymis without any sign of inflammation or induration. The epididymis was intensely inflamed and microscopically showed an extensive acute tuberculous process. In view of the fact that the vas was perfectly normal we are forced to conclude that the infection of this epididymis was hematogenous in origin.

Dr. Harry Culver (closing): In answer to Dr. Young's question, I can only state that as far as can be determined from the opened bladder the prostate was entirely removed. That portion closest to the rectum was markedly cellular, while that portion which showed definite prostatic tissue in the microscopic examination was on the superior surface. Whether we missed a portion of normal prostatic tissue I am unable to say, but in accord with your statement, the top of the mass that was removed showed fibro-musculo-glandular elements, while the lower portion showing nothing but the marked cellular mass.

CONGENITAL STRICTURE OF THE URETER

REPORT OF FOUR CASES

HERMAN L. KRETSCHMER

Chicago, Illinois

No subject is receiving as much discussion, and no subject occupies the center of the urological stage so prominently as does the subject of stricture of the ureter in adults. This is due, primarily, to the enthusiasm and untiring work of Hunner, who, by his many contributions, has aroused the interest of urologists all over the country. By reason of the widespread interest and the ample opportunity to study this lesion, it will not be very long before the entire subject of stricture of the ureter, in adults, will be upon a firm basis and become so well stabilized, that many of the disputed and doubtful questions will be cleared up.

Congenital strictures, or so-called congenital strictures, it should be emphasized, are not so easy of study and the cases are apparently not so numerous as are the ordinary cases of stricture of the ureter. As can readily be understood, the cases occur in children, and they are not referred to the urologist for study. Moreover, the condition is often not recognized, and the fact that it is necessary to cystoscope and pyelogram all cases, for which the consent and coöperation of the parents are more difficult to obtain than in adults.

There exists today in the literature on this subject, a great deal of confusion and a lack of clarity in the description and case reports. A perusal of the literature shows that many cases are reported as cases of congenital stricture and no reason or reasons are given by the author or authors that they are reporting a case of congenital origin. It is difficult to understand by what method of reasoning a case of stricture of the ureter with a hydroureter and hydronephrosis occurring in an adult of thirty, forty, fifty, or even sixty years, should be classed as a case of congenital

stricture. The classification of many of the cases of so-called congenital stricture of the ureter surely needs revision, particularly that group which has been classed as congenital and reported late in life.

The arbitrary age of five has been selected by some who believe that all these cases manifest themselves before the age of five. Whether or not this is true remains to be seen.

On account of the arbitrary classification in the literature, it is with some hesitation that I venture to report four cases of so-called congenital stricture of the ureter, the oldest of which was five years and the youngest seven months.

The etiology is obscure and difficult to determine. As is well known, the ureter early in embryonic life consists of a solid mass of epithelial cells, which later undergo canalization to form the lumen. If there is interference with this process obstruction may result. Whether or not this would go on to true stricture formation or whether these cases are the result of an intrauterine infection, I am not prepared to say, for the question of intrauterine infection is one that has not as yet been definitely determined. Are these strictures acquired through some sort of infection other than intrauterine? This, indeed, would be difficult to demonstrate.

CASE REPORTS

Case I. R. E., male, aged seven months. Referred by Dr. John De Witt of Canton, Ohio.

Present complaint. Swelling of the right side of the abdomen, which has been present for five months. When the patient was *two months old* the mother noticed that the right side of the abdomen was much larger than the left side. As there were no untoward symptoms, the mother dismissed the matter from her mind, thinking that her imagination was to blame. However, on several occasions during the next two or three months she again noticed this swelling. One month ago, on account of the increasing size of the swelling a physician was consulted. Patient had had attacks of fever on several occasions during the past month.

Past history. Patient was a normal delivery. According to the mother's statement, the baby did not cry nor fret more than any normal child.

Physical examination. Slightly emaciated, somewhat anemic-appearing child; lies quietly in bed. Examination of the abdomen showed the presence of an enormous swelling in right upper quadrant of the abdomen. It was relatively smooth, soft, and mobile. Examination of the mass did not produce pain. During the examination the mother made the statement that the tumor was much larger the night before they left home but that after the child arrived in the hospital it had decreased in size.

X-ray examination was negative for stone. The kidney outlines could not be determined.

Examination of blood showed whites 13,000; hemoglobin 80 per cent. Blood chemistry showed:

Urea	40
Uric acid	3.5
Creatinin	1.15
Non-protein nitrogen	38

Cystoscopic examination. November 13, 1923. The bladder was normal. The right ureteral orifice was seen and was normal in appearance. The left ureteral orifice was not found.

The second cystoscopic examination (November 26, 1923) was done after an injection of indigo-carmine, to aid in locating the left ureteral orifice. Left ureteral orifice was not found. The right ureter was not catheterized, our object being to catheterize the left kidney in order to study its function, because of the fact that a right nephrectomy was planned. There was no elimination of the indigo-carmine from the bladder at the end of fifty minutes' observation in the cystoscopic room. The urine voided 6½ hours after cystoscopic examination was pale blue.

Urinalyses. Urine cloudy; acid; albumen and pus present: no blood or sugar. Cultures were sterile.

A diagnosis of right hydronephrosis was made and operation advised. In view of the fact that no ureter was found on the left side the thought occurred that perhaps there was a double kidney with but a single ureter, opening on the right side. The possibility that the patient had either a solitary kidney or a solitary cyst was also considered.

Operation. November 30, 1923. Anesthesia—gas-ether. Usual oblique kidney incision was made. Examination showed a large hydronephrotic kidney. The pelvis was greatly dilated and was as

large as a large grapefruit. Because of the large size of the hydronephrotic kidney it was impossible to deliver it through the wound. Examination showed the presence of a stricture of the ureter about 1 cm. below the kidney pelvis. The tumor was aspirated and 600 cm. of cloudy fluid obtained. An incision was made into the kidney. A probe was passed through the ureter and the stricture dilated. The kidney parenchyma was sutured with catgut around a rubber tube. A nephrotomy was done, and not a nephrectomy, because there was no proof of the presence of a normal kidney on the opposite side. Exploration of the left kidney area, through the incision, in order to demonstrate the presence of a left kidney, was unsatisfactory, in that no left kidney was felt. For this reason, together with the fact that no ureter was found at cystoscopy, a nephrectomy on the right side was not done, which, as subsequent events proved, was a blessing in disguise.

Postoperative course. After the operation the patient never voided a drop of urine from the bladder, the urine being passed through the opening in the loin. Recovery from the operation was uneventful. Patient lived from November 30, the day of operation, until December 14.

Autopsy was performed by Dr. Oberhelman. The anatomical diagnosis was as follows: Bilateral hydronephrosis; bilateral stricture of the ureter; bilateral suppurative nephritis; hyperplasia of the periaortic abdominal lymph glands; cloudy swelling of the liver; fibrous adhesions between the spleen and parietal peritoneum, and pancreas and left kidney. Examination of the bladder, prostate, and seminal vesicles, negative.

Right kidney: The posterior surface of the right kidney was covered with exudate and had adherent to it perirenal fat and fibrous and fibrinous adhesions. The kidney was enlarged and the pelvis dilated but collapsed. The junction of the pelvis with the ureter was very narrow and when measured across was only about one-third the diameter of the rest of the ureter. The ureter below this point was normal; not enlarged.

Left kidney: The gray fat which surrounded the kidney was adherent in many places and when an attempt was made to separate it a small amount of pus was seen outside the kidney. The kidney was pale yellow and stippled with hemorrhages. The pelvis was markedly dilated and its junction with the ureter formed a large pointed projection. The junction was very small and the proximal four centimeters of the ureter were directed straight up and adherent to the

outside of the pelvis (see fig. 1) where the ureter made a sharp turn and descended into the pelvis. The left adrenal was adherent to the outside of the kidney. The blood supply was normal. The ureter below the point of stricture was not dilated and its entrance into the urinary bladder was not obstructed.

This patient had a bilateral stricture and bilateral hydronephrosis, that had caused complete destruction of the left kidney, as evidenced

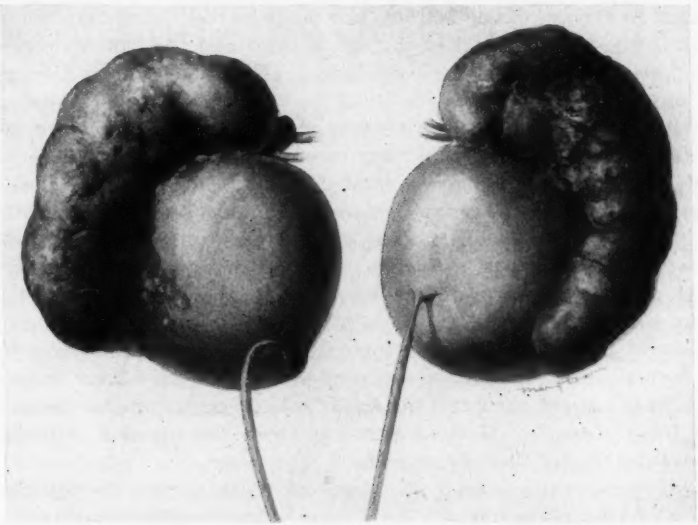

FIG. 1. CASE I

Showing the presence of bilateral stricture with resulting dilatation of both pelves and hydronephrosis. The ureter on the left side, below the stricture, was firmly adherent to the dilated pelvis.

clinically by the fact that no urine was ever excreted from it. As previously mentioned, all the urine drained out of his drainage tube from the right kidney. An attempt to locate the left kidney at the time of operation on the right side failed to demonstrate the presence of a kidney. Undoubtedly this was due to the fact that only a shell of kidney remained, and hence could not be felt. This little patient was evidently living on a very small remnant of kidney tissue present on the right side.

Case II. J. P. R., male, aged five years. Referred by Dr. Thor Jager, Wichita, Kansas.

Past history. This child was a normal delivery; breast-fed for eight months; walked and talked at one year. Patient had measles at the age of one; chicken-pox at the age of two and one-half; and a temporary enlargement of the glands of the neck the winter prior to coming under observation.

Present illness. From early infancy he was subject to attacks of colic. At the age of one and one-half years he had definite attacks of pain in the abdomen and at the age of three and one-half developed the present attacks which have persisted. They occurred on an average of once a week and lasted for about two days, in the interval being perfectly well. The attacks became much worse; that is, with increased frequency. The pain, very severe in character and associated with nausea and vomiting, was located chiefly in the upper left quadrant of the abdomen. During attacks the patient's temperature rose to 103°. Examination of the urine in one attack, six months previous, showed blood and pus. Because of recurring attacks of chills and fever, associated with pus in the urine, the child had been treated for acute pyelitis, before he was seen by Dr. Jager.

General physical examination showed the head, neck, and chest to be normal. Examination of abdomen revealed a very large tumor mass in left upper quadrant, the size of a large grapefruit, not tender, and freely movable. Genitals were negative. Examination of blood showed leukocytes 8400; hemoglobin 92 per cent.

Cystoscopic examination on February 24, 1923, showed the bladder normal. Ureteral openings normal. Both ureters catheterized without difficulty or obstruction. From the left kidney a prompt flow of very turbid urine was obtained. Right urine was clear. The catheterized urines were as follows:

	LEUKOCYTES PER CUBIC MILLIMETER	CULTURE	TUBERCLE BACILLI STAINS	UREA
				per cent
Bladder	62	Sterile	Negative	1.5
Right kidney	49	Sterile	Negative	1.3
Left kidney	11,200	Sterile	Negative	0.1

Phenolsulphonephthalein test

	RIGHT	LEFT
Time of appearance	5 minutes	No thalein from left side
First thirty minutes	12.5 per cent	
Second thirty minutes	19.0 per cent	
Total of one hour	31.5 per cent	

Examination by Dr. Grulee revealed a soft systolic murmur over the apex, which he thought was an adventitious murmur.

Blood chemistry showed:

Urea	38
Uric acid	2.8
Creatinin	1.1
Non-protein nitrogen	30

Pyelogram of the left side showed the catheter extending to the fourth lumbar spine, then making an abrupt lateral curve to the left, and stopping about 2 inches from the spine. A film made while the tumor mass was being pushed mesially showed the kink in the catheter overlying the lumbar spine and the tumor mass pushed considerably toward the midline. The pyelogram showed a large round shadow that extended from the twelfth rib above to the lower border of the fourth lumbar vertebra below, and from the middle of the spine to a line drawn from the tip of the eleventh rib to the crest of the ilium. There was an enormous dilatation of the kidney pelvis and enormously enlarged, clubbed calices. The kidney pelvis measured 8,5 by 9.5 cm. Each of the calices was approximately 3 cm. in diameter and five were shown (fig. 2).

A diagnosis of hydronephrosis, due to stricture, was made.

Operation. On March 6, 1923, under general anesthesia, a left lumbar nephrectomy was performed. The usual oblique lumbar incision was made and the kidney delivered without difficulty. The pelvis was enormously enlarged. At the ureteropelvic junction a stricture of the ureter was found. The vascular pedicle was ligated and cut and the ureter was ligated and divided and removed below the point of stricture. The postoperative course was uneventful.

Description of specimen. The kidney and empty pelvis weighed 52 grams. The kidney was 9 by 3.5 by 2.5 cm. The collapsed pelvis was 5 by 4 cm. The capsule of the kidney had been stripped off and the surface was red, finely granular, and also showed marked *fetal lobu-*

lations. The pelvis was attached to the kidney along the entire length of the concave surface; it was thin-walled and white, and the ureter rose abruptly at its lower distal and anterior aspects. There was a

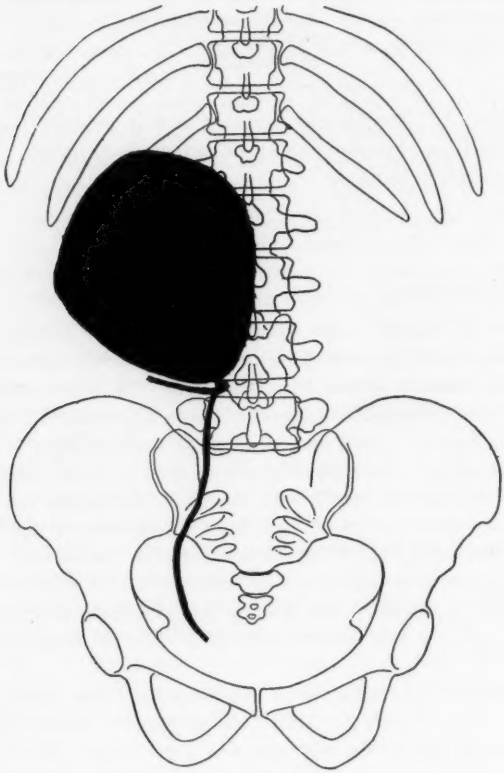

FIG. 2. CASE II

Large hydronephrosis due to stricture at the uretero-pelvic junction extending from the top of the eleventh rib to the fourth lumbar vertebra. Note course of the ureter.

distinct stricture 5 cm. below the origin of the ureter. The average diameter of the ureter was 3 mm., while that of the stricture was 1 mm. Two arteries and a vein entered the kidney anterior to the

pelvis at the juncture of the upper and middle two-thirds. No aberrant vessels were present. On opening the ureter and pelvis the lining throughout was smooth, glistening, and shining. There were no areas of leukoplakia. A septum at the level of the large vessels partially

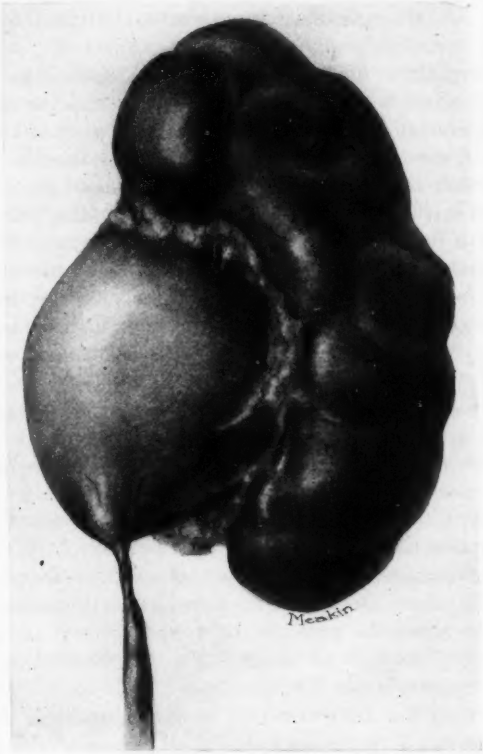

FIG. 3. CASE II

Showing the presence of a stricture below the uretero-pelvic junction, with a resulting dilatation of the kidney pelvis and a hydronephrosis.

divided the pelvis into upper and lower cavities. The walls were uniformly 1 mm. thick. Section of the kidney showed greatly dilated calyces and thinning of kidney tissue. The average thickness of kidney tissue was 5 mm., half of which was medulla and half cortex (fig. 3).

Microscopic. Generalized infiltration of the kidney substance with round cells and polymorphonuclear lymphocytes with areas of fibrous tissue replacement. The sections of the wall of the pelvis were relatively normal condition except for slight round-celled infiltration.

Case III. T. H., male aged three years. Referred by Dr. B. W. Sippy.

Present complaint. At the age of twenty-two months the patient was suddenly seized with chills and fever, the attack lasting about one week. Temperature at the time had varied between 104° and 105°F. There were frequent vomiting spells. Several months later there was a recurrence of the attack, which was followed by a swelling on the right side in the region of the right kidney. This was incised and drained, and a large quantity of pus was evacuated. Frequency of urination began after the operation, voiding being peremptory every two or three hours at night. Pus in the urine. At the time of operation a tube was inserted into the kidney, and so long as the tube was in no urine was passed from the bladder. The father had been told that the boy had only one kidney.

It may be possible that the boy had a bilateral condition and a similar status as was presented in case 1.

Examination revealed a scar on the right side in the right lumbar region, with some tenderness.

Examination of blood showed 14,000 leukocytes.

X-ray was negative for stone.

Cystoscopic examination, September 17, 1921, showed a normal bladder. Left ureter absent. Two subsequent ureteral catheterizations failed to show the presence of a left ureteral orifice. Under anesthesia the results were no better. The right ureter was catheterized and a pyelogram made (fig. 4).

Examination of the urine obtained at the cystoscopic examination was as follows:

	CELLS	CULTURE
Bladder	720	Staphylococcus albus
Right kidney	480	Staphylococcus albus
Left kidney	Not catheterized	

The *pyelogram* showed an enormously dilated ureter, enormously dilated kidney pelvis, and very much enlarged superior and inferior

calices. The fluid in the ureter terminated very abruptly opposite the upper margin of the hip-joint. From these findings a diagnosis of stricture of the ureter with an infected hydroureter and hydronephrosis was made.

Case IV. M. M., female, aged seven months.

Past history. Shortly before coming under observation patient had had an attack of influenza, so-called, after which pus was present, more or less, in the urine. The gastrointestinal symptoms had manifested themselves in four or five bowel movements a day; digestion bad. The temperature rose as high as 103°. Culture of the urine revealed pure culture of B. coli communis. Treatment had consisted of bicarbonate of soda, sodium citrate, and vaccines, but the improvement was only temporary. Had had recurrent attacks of fever, nausea, and vomiting; the temperature rising to 103°F.

Physical examination. Negative.

Cytoscopic examination. October 24, 1919. There was some edema at the base of the bladder and trigone. The ureteral orifices were normal. A few small cysts were seen in the bladder. The passage of a catheter up the left ureter met with some obstruction.

Urinalysis of urines obtained by ureteral catheters showed a few pus cells and cultures were positive for B. coli. Stained sediment was negative for tubercle bacilli.

Pyelograms were made which showed a marked degree of enlargement of the right kidney pelvis, with clubbing of the calices and broadening of their bases. The pyelogram on the left side showed only a moderate amount of enlargement of the pelvis.

The interesting phase of this subject, aside from the etiology, concerns itself with the problem of the early diagnosis so that the proper form of treatment may be instituted. That this lesion is not so rare as one would be inclined to think, is evidenced by the fact that Bottomley, in his very extensive monograph on this subject, was able to collect 25 cases that occurred in children under the age of five. His cases were nearly all autopsy cases, and while a few of them died from intercurrent diseases, most of them died as the result of their urinary tract lesion.

Bugbee, who recently reported a large series of congenital anomalies of infancy and childhood, affirms, as the result of his

investigations, that less than one-third of the infants who had hydronephrosis lived over six months.

The gravity of the lesion, of course, is less severe when it occurs

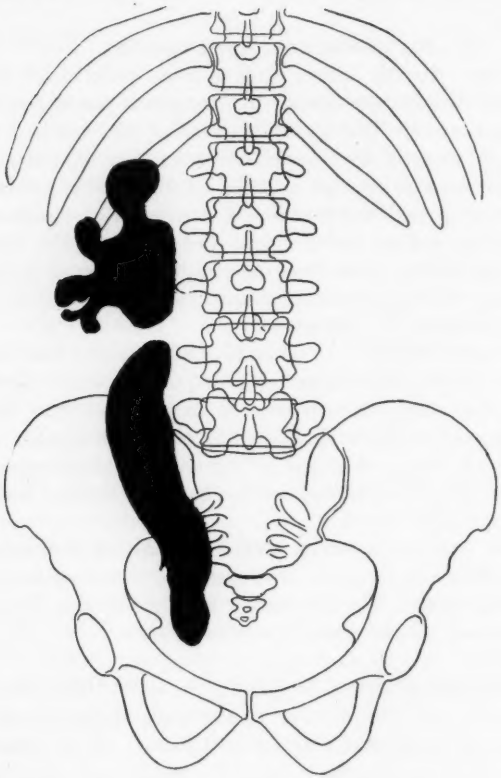

FIG. 4. CASE IV

Showing enormous dilatation of the ureter, with a large hydronephrosis, due to stricture at the uretero-vesical junction.

only on one side, but a review, for example, of Bottomley's cases, shows that out of 22 cases, 5 were bilateral. One case in my series of 4 was bilateral.

There seems to be but little difference in the frequency with

which the right or left side is involved. And the same statement may be made regarding the frequency of occurrence in sexes. There is so little difference in the figures of diagnostic moment that one obtains little help from these factors.

A number of cases are reported in the literature but they are autopsy reports. Evidently during life the symptoms did not lead the clinician to suspect a congenital stricture of the ureter. Even in those instances where there is mention of the symptoms, the fact stands out that the clinician did not focus his attention on the higher urinary tract, but was in a state of doubt as to the real cause of the disturbance, and was more or less mystified as to the cause of death.

Another fact to be borne in mind is that most of the cases were reported in the older literature at a time when these little patients were not given the benefit of a careful and complete urological survey. Even today the problem with which urologists have to contend is the lack of opportunity given them to examine these patients carefully, and the result is that they come to autopsy all too frequently without a clear determination of the exact pathology present. It is not difficult to understand just why this should be the case when the symptoms point but vaguely to stricture of the ureter or when lesions of the urinary tract are suspected. Surely, the only measure to pursue to achieve correct diagnostic results is a complete urological examination. Because the clinical picture is not always typical and the symptoms at times are those of acute infection, are points in favor of a thorough urological examination. In 2 of the cases reported here the treatment before coming under observation was the ordinary one for acute pyelitis.

STRICTURES, BILATERAL

According to Mufson only 8 cases of bilateral congenital stricture have been reported, to which he adds one of his own. Wason has recently reported a case of bilateral stricture in a male seven months of age. Doubtless, as this subject receives more careful consideration and these cases are observed more closely, a large number, not only of single but of double strictures will be reported.

One of the patients in this group (case I) had bilateral strictures, which were found at autopsy, the condition (bilateral) not having been recognized, clinically.

Case 3 in which we were never able to find a left ureter, and in which no urine came through the bladder when the kidney on the opposite side was drained, would suggest the probability that the patient had bilateral strictures, one of which had completely closed, causing complete destruction of the kidney, a condition which occurred in case I in this series.

In one of the cases the patient was sent in because of the presence of a large abdominal tumor, with a tentative diagnosis of tumor of the kidney, probably malignant. In the remaining cases, because of chills, fever, and pus in the urine, the patients were sent in with a diagnosis of acute pyelitis.

Doubtless an attack of acute pyelitis may mask some of these cases of so-called congenital stricture of the ureter and it might be interesting to study a large series of cases of pyelitis which come to autopsy, to determine whether or not they were simple cases of pyelitis or cases of congenital stricture. In other words, would one, in this way, pick up more cases if one followed all cases of acute pyelitis to the autopsy table? There is no doubt that some of these patients whose cases end fatally during attacks of acute pyelitis may have been suffering from an infected hydronephrosis, secondary to stricture of the ureter. Occasionally, there is a very sudden and stormy onset, so that the condition is confused with the so-called surgical abdomen and an operation for acute appenditicis is performed. So long as the hydronephrosis remains uninfected and a palpable tumor is not found, the condition is not suspected. When the hydronephrosis remains stationary and does not become infected, the clinical course is afebrile. In case a tumor is present that varies in size, as occurred in one of these cases, the diagnosis should be relatively easy. The condition has also been confused with malignant renal tumor.

The problem of diagnosis was interesting in Kahn's case, in which the diagnosis was obscured by a history of intestinal obstruction. A megacolon had to be taken into consideration as well as a tuberculous peritonitis.

It should be emphasized that urinary findings may give no intimation of the condition present in the kidneys. Another point of importance to remember is that absence of symptoms pointing to the ureter as the source of the trouble, especially in acute cases, makes a definite diagnosis of ureteral stricture, at times, very difficult before operation.

Because of the relative frequency of bilateral lesions, the data on the opposite kidney should be carefully looked into. It would have been very easy and very simple in case I to have carried out a nephrectomy, which doubtless would have shortened the patient's life.

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THE INCIDENCE OF URETERAL STRICTURE

NATHANIEL P. RATHBUN

From the Urological Service, Brooklyn Hospital, Brooklyn, New York

Received for publication June 15, 1925

During the past ten years there have been numerous contributions to the literature on this important subject, most of them, however, made by a relatively small group of observers, notably Hunner who first called the attention of the profession to this condition as a clinical entity per se.

This paper while presenting little if any thing new is written for the purpose of emphasizing the importance of the subject, illustrating the frequency with which this lesion may be demonstrated if carefully looked for, and stimulating further investigation on the part of a considerable group of observers who have not in my opinion given this subject the careful consideration to which its importance entitles it.

There exists a large group of urologists in which I include myself, who feel that stricture of the ureter occurs very commonly, is easily recognized, and is very amenable to treatment. There is I believe another group who feel that the lesion rarely occurs per se, a few of them even going so far as to feel and perhaps state informally that those of us who are enthused over the subject are pursuing a phantom. I believe that the final test of time will demonstrate as usual that the truth lies somewhere between these two extremes.

It is of course obvious and freely admitted that so long as there remains a group of workers including in its number some of the best minds in urology, who honestly and frankly question the accuracy of our observations, it behooves those of us who are enthused over the subject to proceed with care and caution, to check up our findings carefully and not allow our enthusiasms to warp judgment. It is however equally fair to say that there has

been enough evidence accumulating and presented by a considerable number of workers to entitle the matter to careful consideration and thorough investigation before dismissing it.

It seems to me that there have been several factors that have operated to defer a proper appreciation of this subject by the profession in general and by urologists in particular. Paradoxical as it may seem I believe that one of these factors has been the somewhat overzealous enthusiasm of some of the earlier writers whose claims might well have appeared to the conscientious thinker as being too extravagant to warrant serious consideration. Then too the earlier contributions had very little in the way of concrete tangible evidence, such as radiographs. The hang of the large wax bulb was very convincing to Hunner and others who were accustomed to using large instruments through a Kelly type of cystoscope, but it meant very little to most of us who were accustomed to using smaller catheters through a fluid medium cystoscope, and for whom the use of even a small wax bulb was attended with considerable technical difficulty. Fortunately some of the more modern instruments have greatly facilitated the employment of wax bulbs in male patients, so that it is now a simple matter to employ this method as a check on other methods of diagnosis and also as a material aid in the treatment.

At the present time there are in my opinion two reasons why stricture of the ureter is not more frequently recognized. The first and more important is that this condition is too often omitted from the list of possibilities in approaching the diagnosis of obscure cases. In other words we are not able to demonstrate a ureter stricture unless we deliberately look for it. The mere fact that a No. 6 catheter passes readily to the kidney pelvis does not eliminate ureter stricture any more than does the passage of a No. 30 sound into the bladder eliminate urethral stricture. The second reason is that a ureterogram is often omitted from the routine examination of urological problems and often this is made in such a manner as not to produce a true picture of the entire ureter, particularly the lower third.

I attribute the frequency with which I have contented myself

with a diagnosis of ureteral stricture to a routine procedure which I have followed in my clinic for several years. This briefly is the policy of subjecting every patient in which there is any suspicion of pathology above the bladder to a complete urological survey with the idea of establishing a diagnosis at one sitting. Included in this group there are a considerable number of patients referred to us by the gynecologists and general surgeons for the purpose of excluding any urinary pathology in the absence of

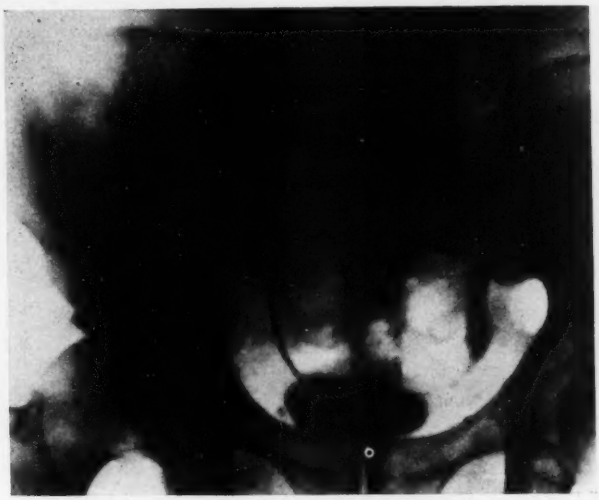

FIG. 1. URETERAL STRICTURE

Pelvic glands mild infection. Frequency of urination. Prompt relief from dilatation.

which the symptoms presented might be attributed to lesions in the tubes, appendix, gall-bladder, etc. This survey includes a careful inspection of the bladder, the passage of radiograph catheters to each kidney pelvis, routine examination of the separated urines, differential renal function tests, a complete x-ray study of the entire urinary tract, with the shadowgraph catheters in position, and a pyelogram and ureterogram of every patient. This is done on the side under suspicion, or if there is no lead pointing

to one or the other side, done on both sides at separate sittings. We practically never make bilateral pyelograms at the same sitting. The technique of making the ureterogram is I believe very important. With the catheter in or near the kidney pelvis, the pelvis is filled with a 15 per cent sodium iodide solution, using a small graduated syringe, injecting very slowly and stopping

FIG. 2

FIG. 3

FIG. 2. BILATERAL STRICTURE IN GIRL OF EIGHT YEARS

Infection: colon bacillus. Frequent recurring attacks of acute pyelitis with hyperpyrexia. Entirely relieved by dilatation.

FIG. 3. SAME PATIENT AS FIGURE 3. LEFT SIDE

immediately at the first suggestion of discomfort. A picture is now made of the renal pelvis. The catheter is then withdrawn a short distance with the syringe containing the iodide solution still connected, then with the plate in position the catheter is withdrawn entirely from the body, injecting the solution at the same time and a picture made immediately. In this way we obtain a picture of the entire ureter, particularly the pelvic

portion. Incidentally one might add that making ureterograms in this way we are less apt to miss double pelvis, bifid ureters, and other abnormalities.

While this of course is considerably more of an examination that many patients require, yet by doing it as a routine we are less apt to overlook some conditions which might otherwise be readily passed by, including ureteral stricture. I do not hesitate to make pyelograms and ureterograms in all of my cases, and since using sodium iodide as a medium I have never had a single reaction in which I have been the least alarmed.

During the year 1924 my assistants and myself made 739 such examinations in my clinic at the Brooklyn Hospital. There were a considerable number in whom our findings were entirely negative, largely among patients referred by the gynecologists and general surgeons. There were however in this group a large percentage in which we were able to demonstrate a urological lesion and many of these patients were spared the danger and discomfort of an unnecessary operation. In this entire group of 739 patients we made a diagnosis of ureter stricture on radiological evidence alone in 92 patients; 48 of these were males; 44 females. Seven of these were tuberculous. Every one is agreed upon the occurrence of this type of stricture, and they are not included in this study. Seventeen cases were complicated by or were a part of urinary lithiasis. Of these calculi were noted in the renal pelvis in 12 cases, in the ureter, 5 cases. It is not unlikely that in some of this latter group the stricture was incidental to and perhaps caused by the presence of the stone. I agree with Hunner however that in many of these cases the calculus is secondary to the stricture. At any rate I am very sure that it is of vital importance to consider stricture as a possible factor in the consideration and treatment of any given case. Failure to do this may be and I am sure often does account for the persistence of or recurrence of symptoms following the removal of the calculus. I believe too that the presence of a stricture may be a contributing factor in some of the recurrent stone cases, by means of interfering with the proper drainage and perpetuating infection.

Excluding the cases with tuberculosis and calculi and four other

cases (two renal tumors, one complicated by calculus, and two bladder tumors) there remain 63 patients in which we made a diagnosis of primary ureter stricture. In 34 of these the urine was free from pus and sterile. Varying degrees of infection were noted in the remainder, 39.

In all cases there was dilatation of the ureter above the stricture and in most of them there were evidences of dilatation of the

FIG. 4

FIG. 5

FIG. 4. TIGHT STRICTURE OF PELVIC URETER

Kink lumbar portion, moderate hydro-ureter and hydro-nephrosis. Moderate infection. Pain and frequency. Relieved by dilatation.

FIG. 5. EXTENSIVE STRICTURE OF RIGHT URETER

Calculus in left pelvis. Right sided pain and colic. No symptoms left side. May account for some cases "referred pain." Relieved by left pyelotomy and dilatation right ureter.

renal pelvis, varying from a slight degree to a well marked hydronephrosis. Practically all of this latter group showed varying degrees of infection, a few (3) having gone over to pyonephrosis with a more or less complete destruction of the kidney. While I realize that the problem of hydronephrosis does not entirely center around ureter stricture I do feel that strictures account for a certain number which could be readily relieved if recognized

early and which might well go on to renal destruction and nephrectomy if neglected. There were in this group 11 cases which were a part of the pyelitis of pregnancy and the puerperium. This I believe is a most important field and I am convinced that ureteral strictures play a very prominent part in these cases and that many of them can be promptly and permanently relieved

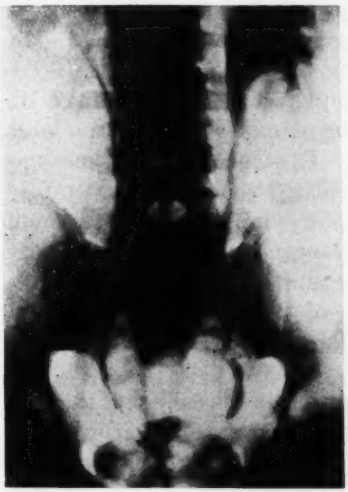

FIG. 6

FIG. 7

FIG. 6. TWO STRICTURES IN PELVIC URETER

Another (?) near renal pelvis. Moderate hydronephrosis. Frequency of urination only symptom. Relieved by dilatation.

FIG. 7. STRICTURE IN PELVIC URETER

Another (not well shown) in intramural portion. Pyonephrosis. Nephrectomy. Late case.

by ureter dilatations. It is interesting to note that practically without exception this entire group of 63 cases were relieved or improved by a line of treatment based on the diagnosis of ureteral stricture. This to my mind is one of the most convincing arguments in the whole matter. Many of these patients have gone the rounds, have submitted to all sorts of treatments, have had

various innocent organs removed, one after the other with no relief, and were promptly relieved by a few dilatations of the ureter. Not a few of them volunteer the information after a simple dilatation that they feel better than they have felt for years. With these facts in mind we can be forgiven a certain amount of enthusiasm on the subject. I have gone a bit further than the radiological evidence would warrant, and have in a few cases made a diagnosis of ureteral stricture in the absence of radiological findings, basing the diagnosis on the symptoms and by careful exclusion of other possible factors in the problem. Some of these have been cases of pyelitis which we have treated with various forms of instillations, taking care however to use a large catheter as a part of the treatment. In others in which there was no evidence of infection we have dilated somewhat expectantly and in many cases with entire relief of symptoms. To my mind this latter item is the most cogent argument of all. The fact that so many of these patients presenting a great variety of symptoms which have resisted all sorts of treatment, operative and otherwise, are relieved by a few dilatations of the ureter, is very convincing.

The hang of a wax bulb and variations in the caliber of the ureter as shown by ureterograms may be a matter of interpretation and variously construed but the relief of symptoms following ureter dilatations is a matter of fact.

In conclusion: While we lay no claim to infallibility and while it is not unlikely that we have erred in some, perhaps many of our diagnoses, this paper is written for the purpose of placing on record the relative frequency of this diagnosis in one clinic, hoping to interest other observers to the extent that they may approach this problem with an open mind and look carefully for ureteral stricture as a part of the diagnostic survey.

REMOVAL OF STONE FROM LOWER URETER BY VAGINAL ROUTE

WM. E. LOWER

Cleveland Clinic, Cleveland, Ohio

Received for publication June 27, 1925

A decision as to the method of choice for the removal of a stone which is partially or completely obstructing a ureter depends principally upon the location of the stone within the ureter and upon the predilection of the individual operator for one or another type of operation.

In presenting the following as the method of choice in cases of stones in the lower end of the ureter in women it is with the knowledge that to others, routes other than the vaginal route are preferred for the removal of stones from the pelvic portion of the ureter. That the vaginal route is not very generally employed by the majority of surgeons today would seem to be indicated from the literature. I have been able to find but two brief references to the vaginal route since 1914, although before that date, especially between 1900 and 1913, a number of descriptions of this operation were published.

Even so, however, the operation seems to have been employed only in isolated cases. I have been able to find only 9 cases reported in the literature although Israel quotes from Jeanbraus's collected statistics that in 10 of his 172 collected cases vaginal ureterolithotomy was performed.

Nevertheless, among the four avenues of approach to ureteral stones within the pelvis, namely vesical, rectal, sacral and vaginal, the vaginal appears to me to be the simplest, the easiest for the operator and the least disturbing to the patient. And I believe also that it has a much larger range of usefulness than would be indicated by the majority of reporters, especially in those cases in which the stone can be palpated through the vagina. Thus Cabot

makes the statement: "This operation has a small field of usefulness. It is only satisfactory when the stone can be readily felt by palpation and in those cases in which it does not tend to slip backward during manipulation. Furthermore, it can only be carried out in parous women when ample room for manipulation is given." This is not in accord with my experience which includes nulliparous as well as parous women and the removal of stones which were so high that their palpation was barely possible.

When the presence of a stone in the ureter has been demonstrated by pyelograms, or by the ureteral catheter, the first efforts toward its removal should consist of complete relaxation with opiates, hot rectal enemas, a hot bath, increased diuresis. If these are not effective, then intraureteral manipulation and dilatation of the ureter should be employed and if these also fail, then a cutting operation must be performed.

When a catheter is within the ureter it is easy to trace its course along the lower end of the ureter by digital examination through the vagina. An inflamed ureter is readily palpated and a tuberculous ureter can easily be determined in this way, the palpation of a hard, tender, pencil-like ureter through the vagina being almost pathognomonic of tuberculosis. I know of no other condition in the ureter which simulates it. When such a condition is found on one side it is almost conclusive evidence that the kidney on that side is tuberculous. A stone in the lower end of the ureter can with equal readiness be palpated by vaginal examination, and whenever it is so palpated, I believe that in most instances it can be removed by the vaginal route with a minimum of traumatism and but a short period of convalescence.

I have performed the operation successfully in 6 cases, the operation failing in 2 cases because the stone moved up the ureter during the manipulation to a point where it could not be reached through the vaginal opening. By the technic now employed, I believe the danger that a stone may move out of reach is greatly lessened. It should be noted, however, that any one who has had much experience in the removal of smooth ureteral stones from a dilated ureter will have had cases in which the stone has moved

away from its first location. So such changes in the position of ureteral stones are not confined to any type of operation.

The technic is very simple. With the patient in the lithotomy position, the cervix is caught with a curved tenaculum and pulled well to the opposite side, thus pulling down the base of the bladder and ureter. The stone is palpated and an incision made through the mucous membrane of the vagina parallel to the ureter. The tip of the index finger is then pushed through this slip and

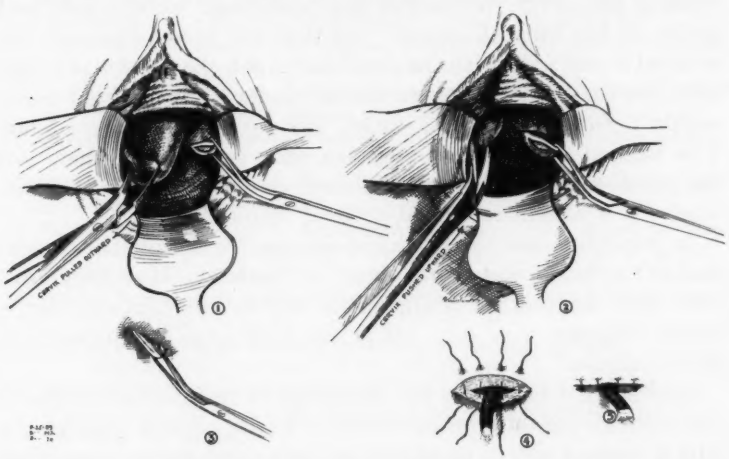

FIG. 1. Cervix pulled outward and ureter pulled through incision in mucous membrane of vagina. Incision made through the mucous membrane parallel to the ureter. Ureter exposed and brought into the wound with curved tenaculum forceps. *2.* Cervix pushed upward relaxing the ureter which is opened and stone excised. *3.* Closure of ureter. *4.* Closure of incision in the vaginal mucous membrane. *5.* Drainage.

the ureter and stone are located. A tenaculum is then placed above the stone to prevent the stone from moving up the ureter. By releasing the traction on the cervix and by gentle traction of the tenaculum on the ureter, the ureter and stone are brought within the opening in the vaginal mucous membrane, at which point the stone can readily be removed through a longitudinal opening. The incision in the ureter is closed with a few fine absorbable sutures and the ureter is released. A small cigarette

drain is inserted through the vaginal slit and is removed at the end of the second day. If there is no leakage of urine, and there is not likely to be, the patient can usually leave the hospital three or four days after the operation.

Garceau in 1904 and also in later reports described an operation which he devised for cases in which the condition of the patient was such as to necessitate the briefest possible operation.

By this method "the anterior cul-de-sac was incised just in front of the cervix, the bladder and peritoneum were pushed back as far as the broad ligament, and then the broad ligament was everted backwards, with the tip of the finger, the stone was caught with the tip of the finger crooked at the last joint, forced downwards toward the vaginal outlet, cut upon and squeezed out. The vaginal and ureteral incisions were sutured together, and the cul-de-sac was left open. The whole operation too, ten minutes. The patient recovered without fistula."

In one of his cases the stone was situated 9 cm. from the bladder and in another it was 10 cm. from the bladder. He states, however, that this method is applicable only in "females with large, roomy vaginae . . . . it is not applicable in females with short vaginae."

Personally, I fail to see the advantage of this method of operation through the anterior cul-de-sac over the incision through the lateral vaginal wall. In one of my own cases three stones were successively removed through a 2 cm. incision in the left lateral vaginal wall. In some cases the stone was so high in the ureter that it could barely be touched by the tip of the index finger. In no instance has convalescence been prolonged. The longest period of leakage noted after any of these cases was twenty days. I, therefore, must take issue with Young who refers to the "frequent persistence of fistulae after the vaginal incision" on the basis of which he feels that the iliac method may prove to be the most satisfactory for even those cases in which the stone is readily palpated through the vagina.

In brief then, on the basis of my own experience, I advocate the vaginal route for the removal of stones from the lower portion of the ureter for the following reasons:

1. It is a comparatively simple method of removing a stone from a location which is often by other methods very difficult.
2. It affords dependent drainage, should there be leakage.
3. It avoids an external incision.
4. It shortens the period of convalescence.

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DISCUSSION

Dr. Arthur B. Cecil (Los Angeles): Discussing Dr. Kretschmer's paper, I have operated on 3 cases of congenital stricture of the ureter in children under five years of age. These were all on the right side. In 2 of the cases, the stricture was at the uretero-pelvic junction. In 1 of the cases the stricture was at the bladder entrance.

In the 2 cases where the stricture was at the uretero-pelvic junction, I did not see how any type of operation could have been done that would have been of any value except the removal of the kidney, for there was practically no kidney substance left, and in one of these cases it was impossible to squeeze urine out of the kidney after it had been removed.

There is just one other point I would like to call attention to, and that is the association of hydronephrosis with a large mass which may seem to be a hydronephrotic kidney but which may prove to be hydronephrosis associated with neoplasm of the kidney. This would not offer much difficulty in differential diagnosis in adults, but the differential diagnosis is more difficult in children, and the association of hydronephrosis with neoplasm in children is fairly common.

Dr. George R. Livermore (Memphis): It has come to a point when we must either take sides with those who believe in stricture or those who do not. I wish to plant my banner behind Dr. Hunner and Dr. Rathbun and to state that ureteral stricture is a definite, pathological entity and occurs more frequently than any other urological condition.

When Dr. Hunner read his paper some years ago and reported 100 cases of ureteral stricture, I think we all looked at it very skeptically. The only reason that I can assign that we do not find these cases is because we have not looked for them.

The old idea of passing a catheter up the ureter and saying that because it met with no obstruction that there was no stricture, is certainly no indication that it does not exist, because if you do not want to accept Dr. Rathbun's pictures, Dr. Hunner's pictures, his diagnostic ability, then I think the proof of the pudding is in the eating, and if these patients have been relieved by treatment to the stricture and nothing else, why should they be relieved if they have no stricture.

Dr. Hunner tells us that we have induration in the urethra in many of these cases, and that so often people treat the urethra and hope to get results and very frequently do get temporary results.

I have a case in mind that I can report which had been subjected to several operations, abdominal and vaginal, without relief, who came to me with an irritable bladder, in whom finding a definite thickening and induration of the urethra, I passed sounds and dilated the urethra, with the most astonishing benefit, and to my mind a proof positive that the trouble was due to the indurated and thickened urethra. But the relief was only temporary and in a very short time she had a return of her symptoms, and, despite further dilations, there was no improvement.

Following Dr. Hunner's repeated advice to us, that stricture was a definite entity, I had passed a No. 6 catheter and finding no obstruction at first was sure there was none. I went into this case more definitely and found a stricture of the ureter, and I am glad to report that under dilations, this woman has been absolutely relieved.

A second case which I had referred to me from a western city I made a diagnosis of ureteral stricture and relieved her of her irritable bladder. She left town, and I had told her that I felt sure she needed more treatment and referred her to another urologist in a middle western city. He, feeling that my diagnosis was incorrect and that the trouble was due to the indurated and thickened urethra, confined himself alone to dilations of the urethra with a return of all of the woman's symptoms. I am glad to tell you that she has come back to me, has had ureteral

dilations, and she has been entirely relieved. I do not say that in the sense of boasting, but it is something that any one of you can do; if you will only look for strictures you will find them, and if you dilate them you will relieve the great majority of them.

Dr. JOSEPH HUME (New Orleans): I would like to speak a little about the cases Dr. Kretschmer described. I have seen a number of these where apparently nephrectomy is the only thing, but this fall I saw a case that has some very interesting points. This was a little girl baby eighteen months old who, from the second month after birth, had had repeated attacks of chills and fever. When she was brought in, she had a large tumor mass on the left side, a functional test of about three per cent and a purulent urine. A study of the case showed that she had no right kidney at all, and just this large hydronephrotic mass, on the left side. We were able to aspirate off about 313 to 500 cc. from this kidney, and I will mention to those who are not familiar with the method that the quickest way to empty these big pus sacs is to attach your ureteral catheter to an aspirating pump. You can then fill up the kidney with a large amount of antiseptic fluid and re-aspirate it. In that way, you can get quick action.

We had this problem of this little child exceedingly sick with very low function. We exposed this kidney under local with a little gas and found the type of picture that is indicated in these illustrations.

In all of the cases that I have operated on, the ureter is closely attached to the pelvis and as the hydronephrotic sac grows larger, the ureter becomes more compressed. In this case, I took out a large section of the pelvis, and did a Heineke-Mikulicz on the uretero-pelvic junction, put a tube through the cortex into the pelvis and also one in the pelvis.

After two or three days of temperature, the child did well, and it looked as if she was going to have a perfect recovery. About the third week, the temperature started again and after some study we found we were dealing with cortical abscesses of the kidney. The child died in the seventh week.

The interesting part is that the functional test came up from 2 to 3 per cent to 18 per cent, showing that this kidney which just seemed to be a shell could be improved by drainage, and the pelvis had completely come down from this huge sac of 450 cc., so that at the autopsy it held exactly 30 cc. under great tension. I autopsied the case, found a perfect mechanical cure of the kidney, and that there was no kidney on the other side at all.

Dr. Guy Hunner (Baltimore) (By invitation): Thank you for giving me an opportunity to speak. I have been extremely interested in all of these papers.

In regard to Dr. Kretschmer's, I think we are all agreed that it is only by future work, as he said, and particularly by microscopic work, that we are going to be able to get a line on which of these very young cases are purely congenital and which are inflammatory in origin. Dr. Kretschmer's pictures did not all appeal to me as being those of stricture. It seems to me that some of them are pictures of some congenital deformity of the pelvis itself, in which the upper end of the ureter has secondarily become involved, but I believe he has microscopic studies on most of them, and that ought to settle the point.

Regarding Dr. Lower's paper, I am not as enthusiastic now as I was some years ago about the vaginal route for taking out stone, for this reason—I have found that stone is practically always associated with stricture, and that there is not only the one stricture in which the stone lies, but very often others, and I can get a better picture of the whole field through a McBurney incision and an ex-peritoneal exposure, and handle the whole situation more satisfactorily and get a more certain permanent result than through the vaginal route. The vaginal route is especially valuable in stout women, and whenever used, one can dilate the neighboring channel, by passing dilators up the ureter; and to dilate between the stone area and the bladder one can bend the uterine sound or some malleable instrument and pass down into the bladder.

Of course, Dr. Rathbun's paper on the "Incidence of ureteral

stricture" has interested me most of all. It is rather difficult for those who have actually investigated the problem to have many differences to discuss. We all realize that there are a tremendous lot of problems that we have got to solve in the future, but we come to an agreement pretty thoroughly on the great incidence of stricture, on what it means to kidney pathology, what it means to the gynecologist and the surgeon in errors of diagnosis and we are pretty well agreed as to the sort of a result you will get by treating stricture, so that on the main points we have come together pretty well. It is just a question, as Dr. Rathbun said, of looking for stricture if we wish to know what the incidence is.

I must agree with his first paradoxical statement, as he called it, that the revulsion of feeling of the urologists in the beginning was due to the over-enthusiasm of the early workers. That was a very kindly way to put it. He did not even say over-enthusiasm; he said enthusiasm. Perhaps I could put it a little more picturesquely if I state that to have a maverick get loose from the gynecological pasture and wander over into the urological field and tell the urologists what a bully lot of fellows they are and what wonderful work they have been doing in the last quarter of a century, resulting in placing their specialty in the very front ranks of medical science, and then to turn around and tell them that they have been overlooking the most important lesion in the urinary tract; of course a man could only expect one sort of treatment, and I got it.

There was a period of silence which I think was the hardest one that I have passed through, and then a second period in which there was vociferous denunciation and denial. There was more fun in that. There is always more fun in a fight than to have to sit quietly and take the sneers.

We have entered, I hope, the third stage in which every sane urologist is going to really investigate the subject, and it is just possible that you will be surprised, as I have been time after time, at the incidence of ureteral stricture. I have followed Dr. Dan McLaren's injunction a great many times of shutting myself in a closet and asking myself if I were just a plain fool, and this

because of the finding of so many of these cases and wondering what we could have been doing with them previously.

But if you will come into my dispensary any day and see these patients with five or six scars over the abdomen, you will know what we have been doing with them previously, and, as Dr. Rathbun has said, the results we are getting on them are extremely helpful in confirming our viewpoint that we are on the right track.

Dr. JOSEPH F. MCCARTHY (New York): During the past few years two things have come out of the South, that attracted considerable attention, the one Coca Cola, and the other ureteral stricture, both equally stimulating. I desire to discuss the latter from the technical standpoint. It was with the intention of simplifying ureteral stricture diagnosis and treatment that I undertook the instrumental research work resulting in the new Foreoblique Pan-endoscope, which has removed the last excuse for failure to apply the work of Hunner to the male as well as the female. If those of us therefore, who are not familiar with the Kelly method or who being familiar, do not care to use it, will give this new instrument a little patience and some measure of application, they will, I am sure, acquire some at least of this religious, almost fatalistic enthusiasm.

Dr. RICHARD F. O'NEIL (Boston): It may interest Dr. Lower to hear that over twenty years ago I helped Dr. Garceau perform his first operation for vaginal removal of stone. The patient was at St. Elizabeth's hospital, anuric, and very ill. The operation was very rapidly done, and the convalescence very satisfactory. It seems to me in certain selected cases, it is an excellent route.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): Dr. Hunner deserves great credit for calling our attention to the more frequent existence of ureteral stricture than we formerly supposed, but it remains to be determined how often it occurs and causes symptoms. I think that this Society should not go on record as endorsing his extreme position.

It is open to question whether a diagnosis of ureteral stricture can be made unless dilatation can be shown existing in that ureter. The great trouble, however, arises in determining whether or not a stricture exists from an interpretation of the ureterogram. The personal equation in this interpretation is so great that I dare say a good many of us will not agree as to the exact condition present. Furthermore, I am under the impression that apparent strictures of the ureter are frequently not due to actual stricture but to ureteral spasm, and that apparent dilatations of the ureter can exist due to spasm without any actual stricture being present.

It should also be remembered that dilatation of the ureter can be present as the result of inflammatory reaction, and not necessarily due to obstruction. I believe that both processes are sometimes present.

In demonstrating the fact that strictures frequently occur with chronic pyelonephritis, Dr. Hunner has made a valuable contribution. I am under the impression, however, that these strictures occur secondary to the renal infection and are not primary and pathological.

With our present clinical evidence of stricture in the ureter it would seem advisable that we should adopt a conservative attitude. I hope that in the future we will have more pathological evidence available as to the exact lesion present.

Dr. HUGH H. YOUNG (Baltimore): I would like to ask Dr. Rathbun in regard to the stricture that he found in males. It seems to me the question of inflammatory condition around the seminal vesicles and back of the bladder has been lost sight of in the pathological and surgical description and study of a great many of these cases.

Many years ago, I reported, I think, the first case of stricture of the ureter supposed to be due to inflammatory lesions of the seminal vesicle encircling the stricture, and published a photograph of the specimen which I think was very conclusive. Since then we have seen a few other cases. I would like to ask Dr. Rathbun how many of these cases showed stricture due to ad-

hesions to the seminal vesicles or vasa deferentia, and whether he found those cases relievable by dilatation.

In the few cases I have seen where such strictures were definitely demonstrated, there was so much inflammatory fibrosis around the ureter that I hardly believe they could have been relieved by mere dilatation within the ureter, any more than deep strictures of the urethra with extensive fibrosis can be relieved by mere dilatation of the urethra.

The subject is one of great interest. We owe Drs. Hunner and Rathbun and others a great debt of gratitude. I agree, however, with much that Dr. Braasch has said.

Dr. ANDREW J. CROWELL (Charlotte): I have agreed with Dr. Hunner, that there is such a thing as ureteral stricture, ever since he first called our attention to this condition. I have never been able, however, to find them anything like so often as he finds them. I have never agreed with his plan of diagnosing the condition. Repeated ureterograms is the better method in my opinion.

The caliber of any normal ureter varies at different levels and the narrowed areas can easily be detected by the bulb. In fact, the presence of the bulb in the ureter will cause a spasmodic contraction of the ureter and produce the "pull," mentioned by Dr. Hunner, in practically every case.

I hold in my hand a picture of a case of hydronehprosis due to ureteral kink which was diagnosed ureteral stricture—not by Dr. Hunner but by a person who followed his plan of making the diagnosis, but, as the uretero-pyelogram shows, the obstruction was produced by ureteral kink.

This patient has been operated upon six or eight times and has had everything done from a thyroidectomy to the removal of one ovary, then the uterus, and I do not know what else has been done. She is a sufferer and a genuine neurasthenic. I believe this condition however is sufficient to produce pain but am also sure it is greatly magnified. I really brought this picture along to show it to Dr. Braasch and get his advice as to what is the best course to pursue in her case, since she has been

under his care. To me it is quite an interesting case, and whether or not she can be cured by any method after all these operations, I am doubtful. She has a mania for operations and I am afraid she is a morphine addict, though we have been unable to prove that such is the case. We had no trouble in getting a No. 6 ureteral catheter by the kink. It was in for three days. Saturday, when this picture was taken, they put in a No. 11 ureteral catheter and probably will leave it for three or four days in an endeavor to dilate the ureter and straighten out the kink. Before the retention catheter was used the ureter was normal below the kink but considerably dilated above. This picture shows considerable dilatation of the ureter as the result of the retention catheter.

Should this procedure fail to give relief we will probably do a ureteroplasty.

Dr. WILLIAM E. LOWER (Cleveland): In any discussion of stricture it is very necessary that we define clearly to what we are referring. In general we are considering a ureter in which certain pathological changes have taken place and therefore I do not believe that we can cure one of these organic strictures by simply passing a catheter through it once or twice. As none of these cases die we get no post-mortem examinations so cannot have any pathological reports upon which to base our final judgment.

It seems to me that we should not draw the conclusion that the appearance of a contraction on the ureterogram is always indicative of a stricture. Nor can we conclude from a single ureterogram the position of a stricture. A number of plates must be taken as oftentimes a spasmodic stricture changes its position.

I agree with Dr. Braasch that many of these cases are spasmodic. If one watches the ureter as it contracts and dilates during an abdominal operation one can readily see how these contractions can cause temporary strictures, these strictures being passed along the ureter in a manner corresponding to the peristaltic action of the intestines. That there are strictures in the ureter, there is no doubt, but I do not believe that all of

these interpretations made simply from the presence of a contraction should be so classified.

I do not believe that so many strictures occur as are often reported. There may be spasmodic strictures but unless there is a dilation above the ureter the stricture need not be dilated, as the indication for dilatation is obstruction. I am certainly quite sure that we do not see as many organic strictures in men as have been reported in these cases of women.

My associate, Dr. Belcher, has recently brought out a method for diagnosing these strictures which is rather interesting. He determines the length of the stricture by passing an x-ray catheter up to the point of obstruction and then passing a very small tapering non-x-ray catheter past it and making a ureterogram. In this way the exact length of the stricture can be determined, as was demonstrated very strikingly in a special case.

Dr. GILBERT J. THOMAS (Minneapolis): At the present time, I am making an investigation of ureteral stricture. I have examined 150 dead bodies (I can not remember the relation of male and female) and in the first 50 cases we removed both kidneys, both ureters, and the bladder, and used wax bulbs in determining stricture or narrowing, and then the top of the cathether was sewed into the bladder section of the ureter, and pyelograms were made.

In only one instance in the 150 autopsies did we find a stricture of the ureter, and that occurred about the middle third.

I have in my pocket (but time will not permit me to show them) six slides showing strictures of the ureter which occurred at the bladder section. I have one which shows the dilatation as shown by Dr. Rathbun and which to my mind is not a stricture.

I am going to continue this study, that is, removing the specimens, making pyelograms, testing the size of the ureter, measuring it, and if obstructions are found, a section of the ureter will be removed and a microscopic study made of it.

PRESIDENT CHUTE: You may show those slides if you can do it in two or three minutes.

Dr. THOMAS: [Slide.] It is unnecessary to say that there is a stricture there.

[Slide.] Here is a double stricture on each side. There does not seem to be very much dilatation here, and I am not prepared to say that this is a congenital condition. The catheter is passed very easily there. A No. 8 catheter could be passed with ease. These were dilated, and of course the patient was relieved.

[Slide.] Unnecessary to say that there is a stricture here.

[Slide.] Here is a stricture with a turn in the ureter. Whether there is obstruction in the ureter or not I do not know. At any rate, there is a double turn there.

[Slide.] This ureter should have been well filled, and the other picture which I destroyed shows a dilatation of the ureter all the way down the same as on this side.

[Slide.] I think you will all agree with me there does not seem to be very much dilatation of that kidney pelvis. The No. 8 catheter was passed with ease. The No. 9 catheter was passed with ease, the largest one I had at that time. By the way, this patient had no symptoms, there was no pain and no difficulty on the side at all. The patient was examined because of a gall bladder condition, and, as I remember the case, there was a tumor which was thought to be a renal tumor, and a bilateral pyelogram was made.

I may be criticized here for making bilateral pyelograms but I think if this is carefully done, there is no danger.

Dr. ROGER C. GRAVES (Boston): I incline very strongly to the point of view expressed by Drs. Braasch and Lower. It seems to me that in the interpretation of some of these picutres of Dr. Rathbun, particularly those in which there is no very great dilatation of the ureter, that we must bear in mind the possibility of a spastic contraction of the distended organ. So many times in the laboratory I have seen the distended ureter resist distention with active peristaltic contractions, that will make areas of spasm over a small or considerable part of the length of the ureter, and it would be perfectly possible for such

spasms to produce just such pictures as some of these have been. I would not attempt to explain away all strictures on that basis, but it seems to me certainly that that phenomenon must be borne in mind in interpreting plates, and I agree very strongly again with Dr. Lower when he suggests that repeated examinations should be made in borderline cases to prove that a given defect exists at the same point in all of the repeated tests.

Dr. CHARLES H. CHETWOOD (New York): A propos of Dr. Braasch's reference to the importance of correct interpretation of x-ray pictures, a point not my own, but brought out recently by Dr. Gregory Cole, of the fallacious showing that is sometimes conveyed by antero-posterior pictures of an injected ureter. He demonstrated graphically a picture of an injected ureter which was apparently so twisted that there seemed no doubt of the existence of obstruction. While turned to a lateral view it showed that one shadow overlay the other and that what seemed to be a sharp kink was in reality a wide and open loop.

Dr. JOSEPH HUME (New Orleans): I want to agree with Drs. Young and Braasch that stricture in the male is an exceedingly rare thing. I think Dr. Hunner deserves a great deal of commendation, but I do not believe that we have the incidence that Dr. Rathbun gives it of one out of seven urological cases.

This was a long time ago and we did not know much, but I once saw a man suffering with anuria on the eleventh day, a young, healthy man, with no antecedent symptoms of urinary disturbance. Both catheters stopped at about 6 or 7 inches.

After we made this investigation, on the twelfth day, we did a left-sided nephrostomy and exposed the ureter just about to the pelvic brim, where we found a distinct stricture. The man died ultimately and I got an autopsy, and there he had bilaterally in each ureter, just above the pelvic brim, about the fourth lumbar vertebra a beautiful, almond-shaped, fusiform enlargement, around and including the ureter, which on section with a knife cross-wise looked like pure fibrous tissue. There was absolutely no channel in it that you could get the finest probe

through. Macroscopically I would call that a definite stricture of the ureter, as far as I know.

Dr. HERMAN L. KRETSCHMER (Chicago): I was very much interested in Dr. Cecil's reports, and I think that in the main most of these children can be treated or ought to be treated by nephrectomy. On the other hand, the possibility that the lesion is bilateral must be thought of and occurred in one of my cases as well as in one of Dr. Hume's cases. The apparently good result that Dr. Hume got with his procedure I think should perhaps make us stop and think before we really do a nephrectomy in these patients.

It was not quite clear to me why his patients with solid tumors of the kidney show a variance in the size of the tumor. I wonder if he would tell us whether or not those patients had a coexisting hydronephrosis.

The phenomenon that Dr. Hume mentioned, namely, that as the pelvis enlarges in these cases, the ureter becomes attached to it, is evidenced in one of the pictures that went around in which the stricture was above the place of attachment.

I do not quite agree with Dr. Hunner regarding the matter of whether my cases, were due to "congenital" strictures or not. In the one instance at autopsy and in the other in which the kidney was removed, definite evidence of fibrosis was present in the ureter on section, and there was a definite point of narrowing at the point of stricture. It seems to me, in view of the fact that strictures everywhere in the body, produce a dilatation above the stricture, that the primary lesion is the stricture and not the hydronephrosis. I do not know of any congenital lesion in the kidney pelvis that would make a hydronephrosis that way. Needless to say, there were no aberrant arteries found.

One specimen that Dr. Thomas showed, in which he had a spindle-shaped dilatation, in a way supports Dr. Braasch's statement that the personal equation enters into the interpretation of pyelograms.

I think as a result of Dr. Hunner's work, we are all diagnosing dilatations of the ureter more frequently than we did before and

that we are on the look-out for them but it is not quite clear to me just what interpretation should be put upon these spindle-shaped dilatations such as he showed in the lumbar ureter. I think some of them may be due to peristalsis or spasm of the ureter.

We have had occasion in some of our pregnancy cases, for instance, where we do bilateral pyelograms, to see a spindle-shaped dilatation of the lumbar ureter on one side, and then make a pyelogram on the other side, and see that spindle-shaped dilatation down in the pelvic portion of the ureter, as though the fluid were being transmitted down the ureter by peristalsis. On the other hand, we have seen a spindle-shaped dilatation in the lumbar ureter and have verified its presence a week or ten days later. It is difficult to believe that if one makes subsequent pyelograms or ureterograms, that one will pick up the spindle-shaped dilatation in exactly the same place weeks afterwards, and as far as I am concerned, it is not quite clear to me just what significance should be attached to these spindle-shaped dilatations.

I think that Dr. Braasch is, maybe, right that all of the dilatations are not due to stricture. I just wish to call your attention to the fact that in the pregnancy cases in women without infection, with sterile urines, one finds dilated ureters, and with the delivery of the child dilatation rapidly disappears. If you will take pyelograms two weeks after your woman has been delivered, you will find that most of that dilatation has disappeared. On the other hand, we have seen patients in whom the dilatation has not disappeared and pyelograms led us to believe that those patients have strictures of the ureter.

Regarding Dr. Young's statement, we have had one or two patients who have had definite evidences of old chronic seminal vesiculitis with definite strictures of the ureter that were very hard and very fibrous, and were treated by operation.

Dr. NATHANIEL P. RATHBUN (closing): I presented this paper purely and simply for the purpose of stirring up a discussion. So far as I know, this subject has not been formally discussed

in the Society before, and it seems to me it is altogether too important a subject to neglect.

I have no doubt, as I said in the paper, that just this sort of thing is going to bring us down to the proper level and proper appreciation of the real truth in the matter, and I have no doubt that the truth lies somewhere between the extremes perhaps represented by Dr. Hunner and the other extremes represented by a good many of the other gentlemen here present.

Taking up a few of the points seriatim, Dr. Braasch speaks of some of these cases being spasm. I have no doubt they are, some of them. I think a good many of them are not because we have made repeated ureterograms in many cases, and we have found the same obstruction in the same place and the dilatation exactly the same.

As for the matter of inflammatory reaction, certainly they are the result of inflammatory reaction, and I have no doubt that some of these are secondary to a pyelo-nephritis or a pyelo-ureteritis which leaves a scar in the ureter in much the same way that a urethritis leaves a scar in the urethra.

In regard to Dr. Young's question about seminal vesiculitis, we have seen a number of such cases. Perhaps Dr. Young will be interested in this case of a patient that had seminal vesiculitis. I think that represents peri-seminal vesiculitis. Some of those shadows may be glands. That patient had been treated in our clinic for it by means of massage for his vesiculitis. He was promptly relieved by dilatation, at first with a very small instrument.

He went out from under observation after being followed for several months, and for all practical purposes was entirely relieved of symptoms.

Dr. YOUNG: About how many dilatations?

Dr. RATHBUN: He had three or four or five.

That leads me to one other point. I believe that most of the strictures I have found have been in the pelvic ureter, and I believe many of them are due to a direct extension of inflam-

matory processes, adjacent lymphatics, or directly from the seminal vesicals, pus tubes or something of that sort.

Dr. Lower speaks of these cases being cured by a few dilatations of the ureter. Well, they are not cured; we do not consider them cured. We ask them to report to us at gradually increasing intervals over a long period of time. They are relieved by a few dilatations, and we treat them just as we would a stricture of the urethra, dilate them up to a certain point, and ask them to return at further intervals for further dilatation and checking. The sexes are about equally divided in my cases. That series of 150 autopsies of Dr. Thomas is interesting, and after all, frankly and honestly, it does not prove that there is not such a thing as stricture of the ureter. You might do 150 consecutive autopsies and not find one of them with a stone in the kidney, and that does not prove that people do not have stones in the kidney. As Dr. Graves says, I think perhaps some of us have a little different idea of what constitues a normal pyelogram.

Our incidence was not 1 in 7, but about 9 per cent. As for the question of what the pathology is, there may be various things in the pathology. There may be ureteritis, peri-ureteritis, there may be some surrounding tissue like the glands one of the gentlemen spoke of, but after all, it is clinically and mechanically an obstruction. Call these things what you like, I think the important thing is that dilating these obstructions relieves the symptoms.

OBSERVATIONS ON MALIGNANT EPITHELIAL NEOPLASMS OF THE BLADDER

JOHN L. CRENSHAW

Section on Urology, Mayo Clinic, Rochester, Minnesota

Tumors of the urinary bladder constitute one of the unsettled problems which confront the present-day urologist. Regardless of the method of removal of the tumor, there are many recurrences and a high mortality. At the Mayo Clinic prior to 1920 the definite verbal instruction to patients regarding the necessity for repeated postoperative cystoscopic examinations were usually disregarded and most of the patients, if they returned at all, came only when extensive recurrent lesions with severe symptoms drove them to have something done. It was obviously impossible to expect the best results with such handicaps. In 1920 a follow-up system was instituted, according to which the patients are required to return for cystoscopic examination or to furnish a report by some other competent urologist at stated intervals after removal of the primary growth, namely, two periods of three months each, one of six months, and then each year up to five years. After five years without recurrence the patient is dismissed as cured. Should the growth recur the patient, of course, reverts to the three months' interval. Letters are written just before the date of return, making an appointment and urging the patient to coöperate. At first it was difficult to get patients to return at repeated intervals. At present, however, largely because on their return they talk to new patients in the hospital, it has become quite "the thing" to come back for cystoscopic examination. More than 90 per cent of all patients with tumor of the bladder will return to the Clinic. There are records in the Clinic now, including current cases, of 538 patients whose cases have been followed.

Formerly, when a diagnosis of tumor of the bladder was made, the gradation of malignancy and the consequent prognosis were based largely on the cystoscopic findings, as about the best that could be expected from a pathologist was to distinguish in doubtful cases between neoplastic and inflammatory tissue. In 1920 Broders published his method of grading the malignancy of squamous-cell epitheliomas by the microscopic findings in the individual tumor cells. The basis of Broders' method is as follows:

> If an epithelioma shows a marked tendency to differentiate, that is, if about three-fourths of its structure is differentiated epithelium, and one-fourth undifferentiated, it is graded 1; if the differentiated and undifferentiated cells are about equal, it is graded 2; if the undifferentiated epithelium forms about one-fourth of the growth, it is graded 3, and if there is no tendency of the cells to differentiate, it is graded 4. Of course, the number of mitotic figures and the number of cells with single, large, deeply staining nucleoli (one-eyed cells) play an important part in the grading. Cells with mitotic figures and the prominent nucleoli should really be considered only as undifferentiated; however, when mitotic figures are numerous, especially if they are of an irregular nature, one is inclined to raise the grade to some extent.

After nine years of experience in grading epitheliomas, Broders concludes that the proportion of differentiated and undifferentiated cells graded 3 and 4 should be altered so that the most malignant of those graded 3 will be graded 4 (figs. 1, 2, 3 and 4).

This microscopic classification, although made independently of the cystoscopic findings, has since then agreed so closely with the cystoscopic picture and terminal results that the method of treatment now depends largely on Broders' gradation. In the few cases in which there has been a difference of opinion as to the grade of malignancy, the end results have usually proved that the microscopic diagnosis was correct. I believe this probably explains some of the unusual cures of extensive, high-grade malignant disease which have been reported; the diagnosis was not microscopic and the neoplasms were actually of grade 1 or

2. I might state here that we have not found at the clinic any instance of the growth showing a change in the microscopic grade of malignancy on recurrence, nor has more than one grade or changes of grade in the same growth been seen.

The method of treatment in the Mayo Clinic, although varied

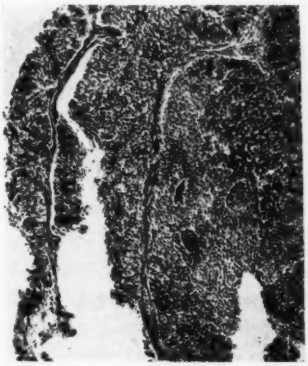

FIG. 1. GRADED 1

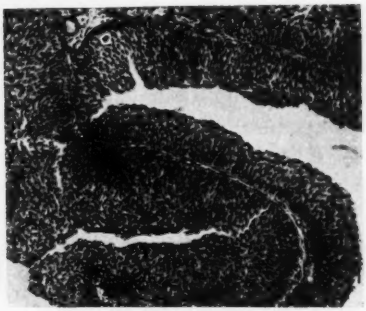

FIG. 2. GRADED 2

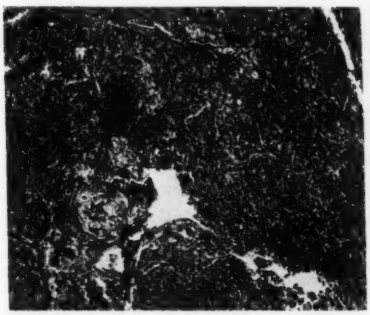

FIG. 3. GRADED 3

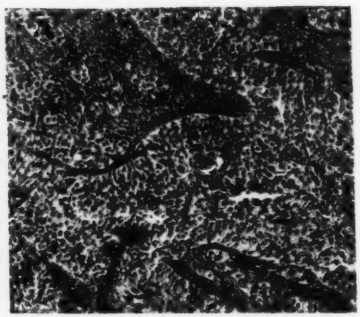

FIG. 4. GRADED 4

FIGS. 1, 2, 3, AND 4. EPITHELIOMA OF THE BLADDER,

somewhat by the conditions in the individual case, follows certain general rules. Neoplasms graded 1 and 2 are fulgurated except when the extent of the growth or its situation renders this impracticable, when suprapubic cauterization or excision is

resorted to. Tumors graded 3 are fulgurated only if very minute; they are usually resected. Tumors graded 4 are resected with the entire thickness of the bladder wall, regardless of the size of the tumor. Recently diathermy has been tried in all grades, but it is too early to estimate results. Radium is apparently helpful in many cases of tumors graded 1 or 2, but of little value in those graded 3 or 4, while its uncertainty and the length of time necessary to determine the results of such treatment make it less desirable than others methods. It is my opinion that most of the tumors cured with radium will respond readily to fulguration without the danger of the "reaction" which sometimes follows the former.

In treatment by fulguration, there are several rules, the observance of which tends to improve results:

1. Treatment should not be considered complete with the mere removal of the portion of the growth projecting from the bladder wall; after this portion has been destroyed and has sloughed away, the ulcer thus left, at the point of attachment of the tumor, and the zone extending about 1 cm. around the original base, should be fulgurated deeply into the bladder wall. When possible, it is best to denude the area to be destroyed before attacking the growth itself, so that there may be no question about the extent of the tumor. I do not believe it makes any difference in the end results whether the growth is melted down by fulguration of the free surface or whether the pedicle or base is attacked directly; certainly the latter saves time.

2. When the growths are 0.5 cm. or less in size, the fulguration of both tumor and basal area should be completed on one growth before the treatment of another is begun, as it is often difficult definitely to locate the exact area even a week after fulguration. If incompletely treated, such bases are a fertile source of recurrence.

3. When multiple growths are situated in or near the dome of the bladder, it is usually best to fulgurate the highest one first, as the bubbles of gas, which cannot always be evacuated, may collect in the dome, obscure the field, and thus render later cystoscopy necessary.

4. Growths in the dome, which would otherwise be out of

reach, can often be fulgurated if pressure is exerted suprapubically.

5. Growths in or adjacent to the sphincter, especially if above it, can often be fulgurated to greater advantage through a direct cystoscope.

I have seen no bad effects from removing a specimen of these growths for diagnosis. Nor is there any reason why the larger portion of a growth may not be removed with a specimen taker, and the base then fulgurated.

In spite of the success of the follow-up system in getting most of these patients back before recurrent lesions, if any, have attained considerable size, and in spite of the accurate knowledge of their malignancy, the end results when tumors are graded 3 and 4 are far from good. Bumpus reviewed 166 cases of tumor of the bladder treated surgically at the Mayo Clinic; the results were as follows: out of 68 patients with neoplasms graded 1 or 3, 40 were living and 15 dead, while, of 98 with neoplasms graded 3 or 4, 38 were living and 50 dead. Other methods of treatment gave similar proportions.

It has been observed in the Section on Urology in the Clinic, that while the situation of the tumor method of removal, duration of the growth, and so forth, unquestionably play a part in the end results obtained, the determining factor is the grade of malignancy. With this fact in mind I have tried to determine how the tumors graded 4 and the more malignant of those graded 3 differed from the low grades of malignancy so far as fatal recurrence is concerned.

CAUSES OF RECURRENCE

Theoretically postoperative local recurrence or extension of the tumor, regardless of the method of removal, might occur from: (1) implantations, either before or at operation; (2) contact transplants; (3) extension along the lymphatics; and (4) direct extension beyond the tissue removed at operation. I am excluding the enormous inoperable type which is so far advanced that it is extending along all lines, and from which little can be learned.

Implantations. Implantations, which have occurred prior to operation and are too small to be seen, as well as those from cells broken off at the time of operation, should give rise to small superficial recurrent growths which, if seen three months later, are easily destroyed and would rarely result fatally.

Contact transplants. Contact transplants undoubtedly occur and it is interesting to see how often multiple growths in the dome and side walls or base will come into definite contact if the bladder is observed practically empty with a direct cysto-

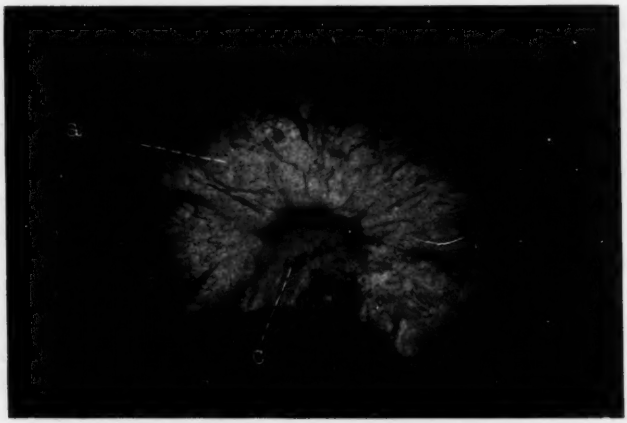

FIG. 5. LOW-GRADE EPITHELIOMA SHOWING ABSENCE OF BULLOUS EDEMA AND NO INVOLVEMENT OF THE MUSCULAR COAT

a, neoplasm, *c*, muscular coat

scope. In many of these instances it did not seem possible, when observing the bladder even partially distended, that the growths could come together. Such contact transplants, if not large enough to be observed at operation, should be sufficiently superficial to be permanently destroyed three months later.

Extension along the lymphatics. According to Poirier and Cunéo modern investigators deny the existence of absorbent lymph vessels in the vesical mucous membrane and maintain that the only lymphatic network of origin which exists in the

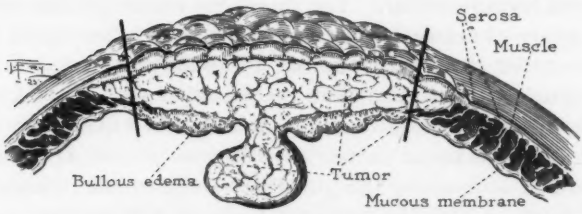

FIG. 6. THE USUAL EXTENSION OF EPITHELIOMA, GRADED 4, WITH WIDER INVOLVEMENT OF MUSCLES THAN OF MUCOUS MEMBRANE, AND USUAL LINE OF RESECTION, WITH PORTION OF TUMOR REMAINING

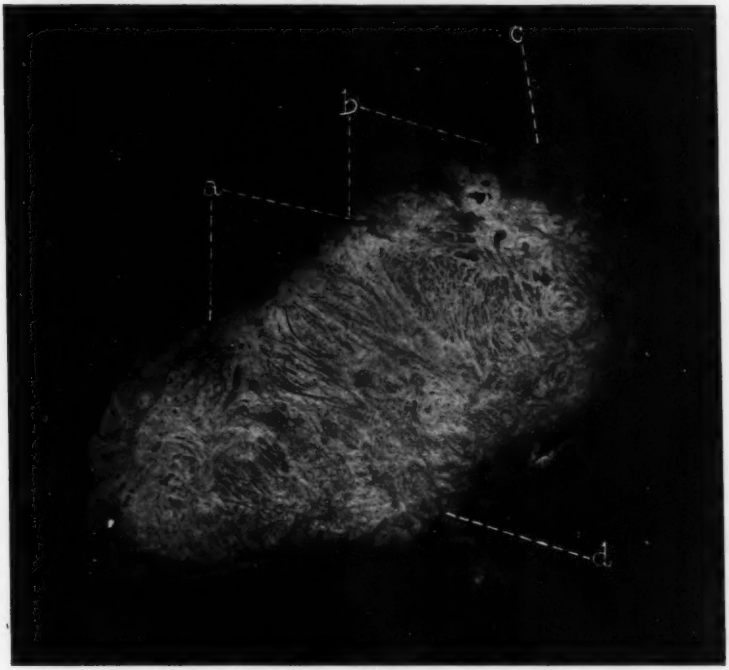

FIG. 7. HIGH-GRADE MALIGNANCY

a, area of mucosal involvement, *b*, bullous edema, *c*, involvement of muscle beyond bullous edema, *d*, involvement of perivesical fat.

bladder is intramuscular. The emergent vessels of this network end in a second network placed on the outer surface of the vesical muscle, under the peritoneum or the umbilico-prevesical fascia. The vesical lymphatics end in the external iliac glands, in the hypogastric glands and in the glands at the bifurcation of the aorta. The prevesical network is continuous also with the network which surrounds the prostate, the seminal vesicles, the vasa deferentia and the terminal parts of the ureters.

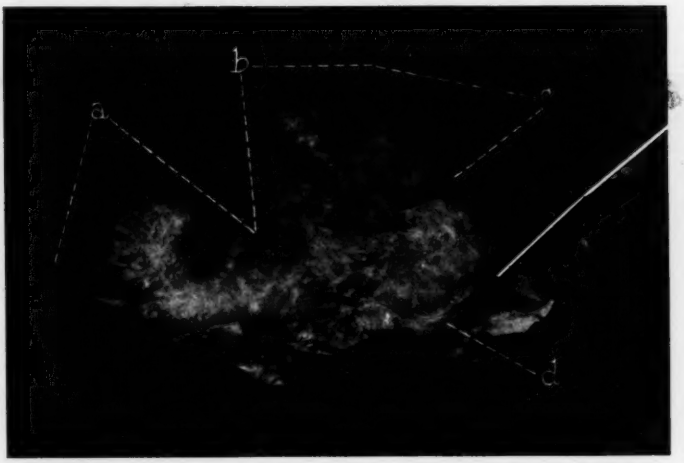

FIG. 8. HIGH-GRADE MALIGNANCY

a, involvement of mucosa, *b*, bullous edema, *c*, involvement of muscles, *d*, involvement of serosa.

It is hard to prove that early extension along the lymphatics does not occur, since by the time the patient dies, necropsy may show implication of the lymphatics. Clinically, however, extension along the lymphatics is so rarely observed in the early stages of the recurrence of neoplasms as to lead to the erroneous conclusion that the bladder is poorly supplied with lymphatics.

Direct extension beyond the tissue removed at operation. This indicates that a portion of the growth has been left at operation (resection, fulguration, and so forth). From the examination

of the surgically removed specimens, I would infer that practically all growths, graded 1 and 2, even when covering an extensive area, involve primarily only the mucous membrane of the bladder (fig. 5). On the contrary, neoplasms graded 3 and 4 early invade the deeper structures, forming a gradually widening inverted V, which covers a wider area in the submucosa, a much wider area in the muscular coat, and may extend to the perives-

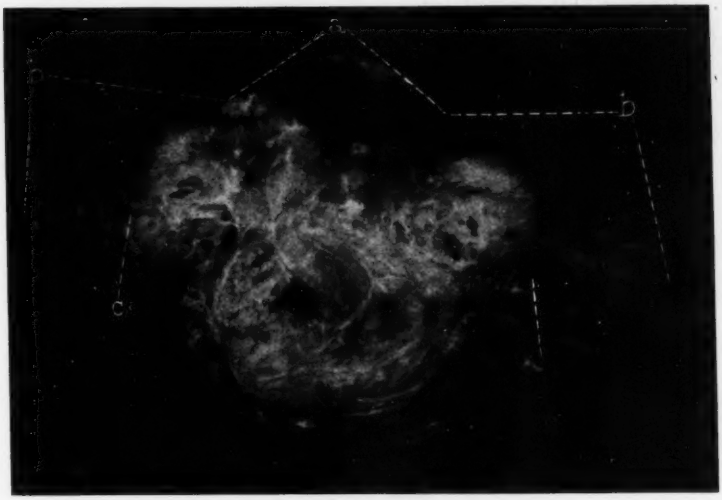

FIG. 9. HIGH-GRADE MALIGNANCY
a, involvement of mucosa, *b*, bullous edema, *c*, infiltration of muscular coat.

ical tissues (figs. 6, 7, 8, 9 and 10). Clinical evidence supports the following conceptions:

1. Many of the extensive neoplasms graded 1 or 2 are cured by comparatively superficial application of the actual cautery, while similar treatment of growths graded 4, or the more malignant of those graded 3, results in a fatal recurrence.

2. These more malignant neoplasms are practically always surrounded by an area of bullous edema, the presence of which Geraghty mentioned as one of the distinctions between benign and malignant tumors. Bullous edema of the mucous membrane

is found only when there is interference with the underlying outer coats of the bladder, as in extension to the bladder wall of perivesical growths or inflammation, a stone in the intramural portion of the ureter, and so forth. It is not unusual to see a relatively small tumor, graded 3 or 4, as viewed from the mucosal side, with a much wider area of bullous edema, which simply means that there is an even wider involvement of the underlying submucosa and musculature.

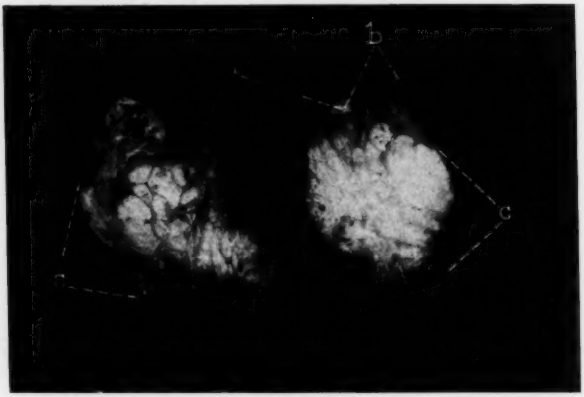

FIG. 10. HIGH-GRADE MALIGNANCY

a, involvement of mucosa, *b*, bullous edema, *c*, areas of muscular involvement beyond bullous edema.

3. In several of the cases there were recurrent lesions just outside of the bladder in the same locality as the original growth, but without any recurrence in the bladder.

While I do not maintain that this is the only reason for the difference in end results in cases of neoplasms in the bladder of slight and marked malignancy, I believe it is certainly a contributing cause. On this account resections of neoplasms graded 3 and 4 should be made to include not only the actual neoplasm in the mucosa, but also the surrounding area of bullous edema and a wide area around the latter including the entire thickness of the vesical wall and perivesical tissues for the same circumference as the excised mucosa.

CONCLUSIONS

1. The end results with malignant neoplasms of the bladder depend largely on the grade of the malignancy.

2. The malignancy of bladder epitheliomas can be accurately determined microscopically, while gross observation may be misleading.

3. Growths graded 1 or 2 may involve large areas of vesical mucosa without extending into the deeper structures.

4. Growths graded 3 and 4 early involve the underlying coats of the bladder in progressively larger areas.

5. Wider resections and the extension of them to perivesical tissues may improve the end results in cases of high-grade malignant disease of the bladder.

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BLADDER NEOPLASMS

DAVID W. MacKENZIE

From the Department of Urology, Royal Victoria Hospital, Montreal

Received for publication June 15, 1925

In considering malignant growths of the bladder we find a great diversity of opinion both as to the pathology and methods of treatment. There are many classifications of these growths, and many ways of dealing with the subject. Some authors depend entirely on the microscopical findings while others are guided mainly by the clinical picture. The great difficulty in the diagnosis by microscope is the transitional type of cell, and the manner of growth. How often in every service do we find the laboratory report "papilloma undergoing malignant change"? Oertel contends it is almost impossible to distinguish between a diffusely growing carcinoma and a sarcoma in the bladder. But the difficulties are not confined to the microscope. The clinical diagnosis has also its problems.

In 1922 Lower reviewed so thoroughly the classifications of Buerger, Geraghty, Judd and Harrington, Barringer, and the end results of Gardner, Thomas, Scholl, etc., and also added so excellent a series of 222 cases of his own that it is unnecessary for me to go into the details of previous experience and conclusions.

The majority of primary tumors of the bladder are of course the papillary fibroadenomata, and the papillary villous cancers. Besides these, squamous-celled cancers with epidermization, and cylindrical cell cancers, are at times noted. Of other tumors, fibromyomata, sometimes with other connective tissue additions, and large, sometimes papillary, nodular, sarcomatous myomata of either smooth or striated muscles occur. Much rarer are the

ordinary small, round-celled sarcomata, spindle-cell sarcomata, and, very rarely, lymphosarcomata and osteosarcomata. In the histogenetic classification of the tumors, according to the type of their parent soil, a distinction is made in the first place between epithelial and non-epithelial tumors. The latter are naturally derived from the deeper layers of the vesical wall, the muscular or the submucosa. Among the benign mature forms, myomas, leimyomas, and fibromyomas are met with, and pure fibromas may also occur. These tumors are usually small, spherical and easily enucleated. They acquire a greater interest when the shape of their cells, and often at the same time also, the type of their growth, undergo a change. In this manner, large, nodular, fibro-sarcomas, sarcomas and myosarcomas, consisting of immature anaplastic cells, may originate. Pure sarcomas are rare.

The tendency of the bladder to the formation of mixed tumors is shown by such malignant tumors being often mixed with various other tissue types; genuine teratomatous mixed tumors have also been observed. There are osteoid chondrosarcomas, rhabdomyosarcomas sometimes with cartilaginous insertions, adenofibrosarcomas and so forth. Furthermore there are angiomas, carcinomas and lymphangio-endotheliomas.

The most important group of bladder tumors are the epithelial tumors. These are derived in part from the epithelial nests or from aberrant prostatic germs, adenofibromas, and adenomas, or they are developed from the surface epithelium. These tumors are the proliferations generally known under the name of papillomas, and papillary carcinomas. In the interest of accurate nomenclature, these tumors should be designated not as papillomas but as papillary epitheliomas or fibroepitheliomas, and as papillary carcinomas, for any tumor can be papillary, including sarcoma whereas the decisive point for the designation is the histological composition of the tumors, and this is fibroepithelial in character.

Probably a larger number of bladder cancers than supposed are extensions from the prostate. Kaufmann states that out of 27 prostatic cancers, 18 had extended to the bladder, and with preference to the posterior wall. This has recently been brought

quite forcibly to our attention in 3 operative cases, and in 2 not operated upon. The growths in the bladder commonly knob-shaped, nodes and plates, covered by relatively normal mucosa or with slight sloughing. They often resemble, clinically, a strawberry myoma, and have slightly the appearance of the aged canned strawberry. Some surgeons believe that many so-called primary bladder tumors are in reality prostatic cancers. The fact that a prostatic cancer may occur in a grossly not enlarged prostate makes this not improbable, even in cases where the prostate is apparently grossly unchanged.

The epithelial tumors of the bladder are often divided into benign papillomas and malignant papillomas. Barringer suggests that the clinical signs of malignancy in these growths are:

1. Induration
2. Slough
3. Resistance to fulguration
4. Single tumor-multiplicity very often means benign tumor
5. Age of patient—Older patients are more probably malignant

Geraghty classifies these tumors as:

- Tumors of epithelial origin
  - Papilloma
    - Benign
    - Malignant
  - Adenoma
  - Cysts
  - Carcinoma
    - Papillary
    - Scirrhus
    - Squamous
    - Adeno
- Tumors of connective tissue origin
  - Sarcoma
  - Myxoma
  - Fibromyoma
  - Angioma
- Tumors of muscular origin: Myoma
- Hetesotopic
  - Rhabdomyoma
  - Hydatid cysts
  - Dermoid cysts
  - Chondroma

This has the advantage of being very simple and very practicable.

Buerger divides them still farther into:

1. Papilloma
2. Infiltrating papilloma
3. Papilloma with carcinomatous changes
4. Primary papillary carcinoma
   a. Papillary polypoid type
   b. Secondarily infiltrating type
5. Primary squamous-celled carcinoma
   a. Infiltrating type from papilloma
   b. Squamous type from papillary tumors
   c. Secondarily prostatic tumor, metastasis from without

In the main these classifications are the same. Personally, I like the general plan of Christeller, and divide these growths as follows:

1. *Typical papillary fibroepitheliomas* (*benign*). Their most important sign is that the epithelial proliferations remain restricted to the mucosa, and is thus directed only towards the interior of the bladder. There is no tendency to grow into the deeper tissues, and these tumors are therefore, displaceable on their base.

2. *A typical papillary fibroepitheliomas* (*malignant*). These tumors although presenting certain histological irregularities, are without the most important signs of malignancy, in the form of destructive growth, they penetrate nowhere into the submucosa or musculatris, and do not give rise to metastases, often reported as benign undergoing malignant change.

3. *Papillary carcinoma.* Characterized by a destructive deep growth into the muscular layer. The superficially papillary structure closely resembling fibroepithelioma is deeply alveolar, as in all other carcinomas. The histological diagnostic examination fully reveals the existence of typical cancer cells, and destructive growth in the second and third stage, so that the diagnosis of malignancy can be positively rendered, the diagnosis of benignity in these cases affording information only of the segment of the tumor examined.

4. Aside from papillary cancers solid cancers also occur in

the bladder, being histologically in part solid cellular medullary cancers, in part scirrhus or alveolar types.

In the literature of the subject the inoperability of a large proportion of cases of bladder tumors is rightly attributed to the length of time which elapses between the first symptom and the operation. The cystoscope has made the diagnosis of the presence of bladder tumors so easy that there is absolutely no excuse for the long untreated histories which we find in those cases.

The history of our own cases varied from two weeks to thirty years. It is not the absence of symptoms that causes havoc, but it is rather the failure to appreciate the importance of early symptoms. Blood in the urine is never physiological; it is a symptom of some pathological condition, and it demands instant investigation. An analysis of 821 hematurias in our clinic showed that 192 were due to calculi, 113 to tumors, 88 to renal tuberculosis, and 143 to surgical infections of the ureters and kidneys, or, excluding the urethra, 536 cases out of 761, that is, over 70 per cent were caused by calculi, tuberculosis, cancer, or surgical lesions of the kidney; while the other 30 per cent most certainly required investigation. The great importance of subjecting these patients to a careful and thorough examination is at once apparent.

There is also another cause for diversity of results in the treatment of those growths. A tumor in the vault of the bladder is altogether a different proposition from a growth surrounding the vesical neck, regardless of what type of treatment is used.

In our own small series of cases, we do not attempt to advance anything new in diagnosis or definite in treatment but only to add our results to those already so well compiled by Lower.

Our list includes:

Total number of cases	228
Total benign, microscopically and clinically	110
Number microscopically, malignant	85
Number clinically malignant (not microscopically confirmed)	33
Total malignant tumors	118
Males	93
Females	25

	TOTAL	MALES	FEMALES
Papilloma, malignant, clinically	30	23	7
Papilloma, malignant, microscopically	9	8	1
Papillary carcinomas	70	60	10
Carcinomas, medullary, etc.	8	5	3
Sarcoma, mixed growth	1	1	0

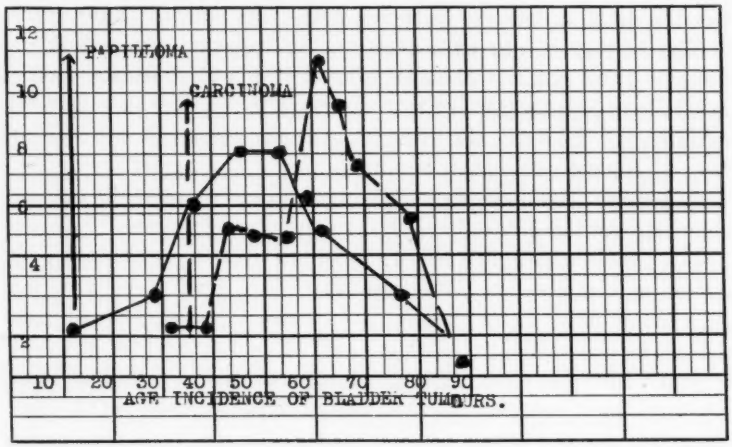

FIG. 1

Age

	YOUNGEST	OLDEST
Papilloma:		
Males	33	71
Females	26	62
Carcinoma:		
Males	30	88
Females	23	71
Sarcoma:		
Male	31	

The pulse, temperature and respiration curve in uncomplicated cases, is no aid to diagnosis, showing no constant variation.

Complaints (according to frequency and order of occurrence)

Hematuria: Chief complaint in 75 per cent of cases, and usually the cause for seeking relief.

Frequency: Chief complaint in 25 per cent of cases, associated in 40 to 60 per cent.

Dysuria: Chief complaint in 10 per cent of cases. Associated in 15 to 20 per cent.

Associated complications: Pain in loin; incontinence; pain in perineum and gentalia. Suprapubic pain, not common.

Relief was sought by patients anywhere from two weeks to thirty years. If there was copious initial hematuria aid was sought immediately. The longer cases, in many instances, proved to be papillomata which had undergone malignant changes.

In the early stages carcinoma is a local disease. The rational treatment, theoretically, at least, is complete and radical excision. In the bladder the disease often remains local for a long period, and does not metastasize readily. Every effort, therefore, should be made to bring these patients for examination early, that we may get rid of the local involvement before it becomes a general condition.

As a great many cases occur in the sixth, seventh, and eighth decade, the history and clinical picture are often combined and associated with signs and symptoms of prostatism. As many of those cases give a history of several years, the age curve does not represent the true curve for the beginning of bladder tumors.

It would appear that the gastro-intestinal manifestations of bladder tumors, as compared with renal lesions, are comparatively few.

Some individuals complained of constipation, this usually proved to be an anatomical effect. Symptoms of hypersecretion (gas eructations, hyperacidity, and the likes) are not the rule, while it is interesting to note that in nitrogen retention, due to conditions of and within the bladder, the urea nitrogen may go to three to four times normal; the creatinine remaining stable and fixed. The gastro-intestinal symptoms in those instances are few.

Loss of weight and strength are marked only in the advanced cases; while the blood pressure findings vary greatly, being low, frequently, in the advanced carcinomata.

Physical examination of the genito-urinary tract. The ordinary examination fails to disclose little that is diagnostic. Abdominal examination may be said to be negative. Occasionally there is suprapubic tenderness, usually present when there is an associated acute cystitis.

Rectal examination in the case of papilloma of the bladder is practically always negative. In the case of carcinoma of the bladder, the infiltration of the wall may cause the mass to be palpable, while nodules in and about the prostate may be significant.

The urine findings are as one might except; there is often macroscopic blood; specific gravity usually shows good variation; associated nephritis, as evidenced by casts is not marked; albumen is present from a slight trace to a considerable degree; sugar was found in only one case in the series, it being a true glycosuria. Microscopical examination shows pus and red blood cells in varying degrees. In rare cases, pieces of tissue were passed in the urine, and were of diagnostic value.

Kidney function (Phenolsulphonephthalein). The phenolsulphonephthalein estimations are usually below normal but, as in the case of the blood chemistry figures, this condition improves, following the establishment of free drainage.

Sufficient blood findings are not available to be of value but in several cases of carcinoma there was a slight leucocytosis. There is usually a varying secondary anaemia.

In addition to the above there may be the usual derangement of the various systems. Only in one case was there a positive Wassermann.

Cystoscopic examinations. Findings at cystoscopic examination usually enable one to make a diagnosis. Occasionally a chronic inflammatory condition which has undergone degenerative or productive change, or extensive bullous oedema, will confuse or complicate the diagnosis.

Treatment

Papilloma of bladder, malignant, 39

Repeated fulguration	19	Cured	12
		Improved	7

Cystotomy and cautery	6	Cured 5; Improved 1
Excision	6	Cured 4; Improved 2
Cautery and radium	5	Cured 4; Improved 1
Not treated	3	

Carcinoma, 78

Inoperable, not treated	27	
Excision	14	Cured 7; Recurrence 6; Died 1
Excision and cautery	3	Cured 2; Recurrence 1
Excision and radium	4	Cured 2; Recurrence 2
Cautery and radium	6	Cured 4; Recurrence 1; Died 1
Excision and transplantation of ureter	1	Cured
Excision and transplantation of ureter and radium	1	Died from metastases 5 months later
Cautery and fulguration (palliative efforts in advanced cases)	11	Cured 1; Recurrence 4; Not improved 5; Died 1
Deep x-ray, inoperable cases	6	Improved 2; Not improved 3; Died 1
Suprapubic drainage for advanced inoperable conditions	5	Not improved 1; Died 4

Mortality includes deaths within three months of discharge. So-called cures were all followed for six months to seven years, mostly one to three years.

Technique used for excision was practically that of Beer. Radium emanation seeds were used entirely in radium treatment.

In conclusion our experience has taught us that certain considerations must be emphasized with care in the attempt to solve this grave problem. The importance of recognition of blood in the urine cannot be overestimated; the examination of the prostate is of equal necessity; the age and development of the growth must be carefully decided; the location of the growth must be definitely settled; freer and more open surgical methods, even in cases of recurrence must be followed; and finally a more thorough and reliable follow up system, extending over the remainder of the patient's life must be adopted. If these considerations and theories are followed with careful practice, our experience convinces us that the ravages of bladder cancer will greatly diminish.

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CONTROLLED DIATHERMY

A NEW METHOD FOR THE TREATMENT OF BLADDER TUMORS[1]

JOHN H. CUNNINGHAM, ROGER C. GRAVES AND WM. T. BOVIE

Boston, Massachusetts

Received for publication June 15, 1925

In the present status of cancer therapy our dependence rests solely upon surgery, and those physical agents which are capable of destroying malignant tissue. In cancer of the urinary bladder with which we are concerned at this time, it is our belief that as yet no method of treatment can be considered as satisfactory. Carcinoma of the bladder remains one of the most important of the undecided urologic problems, and in the absence of new basic principles of treatment our progress lies in the development of existing technique, that the factors already proved to be of the most benefit may be made more effective.

It is not our intent to this time to raise the question of the comparative value of surgery and the physical agents in the eradication of a given tumor, but to present a new method for the employment of heat as a therapeutic measure.

It is obvious, quite apart from whatever procedure is employed, that the successful eradication of malignant disease depends upon the destruction of every malignant cell in the tumor with which we are dealing; and it is essential to preserve intact, at the same time, the cells of normal tissues and vital structures. The degree of our success or failure must be measured in terms of these two considerations.

That the forces of radiant energy are able to accomplish the destruction of malignant growth there is not the slightest

[1] The funds for this work, a part of the general study of heat therapy, were provided by the Medical Research Committee of the Boston Conservation Bureau.

doubt. Heat of sufficient intensity and for a sufficient time of exposure, applied to tumor cells, will kill those cells. It has been proved that radium or x-rays properly applied and in adequate dosage will also accomplish this end.

It is our belief, that in our problem as well as in that of cancer in general, there is lacking one factor of the utmost fundamental importance; that of accuracy of dosage of these destructive forces. We know far too little, for example, concerning the exact penetration of a given unit of radium applied for a given unit of time. The same statement may be made, with greater emphasis, with reference to the application of the so-called deep x-rays.

That these agents are effective and that they are proving to be of the greatest clinical usefulness there can be no doubt. Accuracy of dosage, however, which will destroy the abnormal and preserve the normal, is lacking. The amount of radium to be used in a given bladder tumor is still determined arbitrarily and varies with experience and personal opinion, and there is no present promise of a more exact method of procedure.

Heat as an agent for the destruction of malignant tissue has served a longer period of use than have the two other forms of radiant energy: first, in the form of actual cautery, and more recently as an expression of electric energy. More than a decade ago Percy wrote: "It remains to develop a method of applying heat to the tumor mass to a degree of efficiency that will permit of the greatest destruction of carcinoma cells with a maximum conservation of normal tissue cells." The work of Percy is well known, but his plan of cautery is no longer regarded with unqualified approval. It is open to the very fundamental criticism that the heat produced is developed in the instrument and not in the tissue. Furthermore, as commonly used in spite of Percy's admonition, it quickly forms a char around the iron, thus insulating the mass against the further penetration of heat. This wall of carbonization also interferes with subsequent drainage of destroyed tumor substance from the cauterized area, and thus contributes to the danger of burn toxemia.

The use of high frequency current for the production of heat is by no means new. It has been marked by a slow but constant

growth since the days of d'Arsonval.[2] Variously named and best known as diathermy, it is well defined as "a form of thermotherapy which utilizes electrical energy for the production of thermal effects in the depths of tissues." Diathermy is now being looked upon with increasing favor, and is justly taking its place among the most valuable measures available for the treatment of malignancy. There can be no doubt that the heat of high frequency current is far superior in every respect to that of the actual cautery in tumor therapy. It penetrates more deeply and with greater uniformity. The char of carbonization which forms around the cautery iron, serving as an insulation against the spread of heat, is absent about the diathermy electrode, and there is no barrier to complete coagulation and destruction for as great a depth and extent as the operator desires. Moreover, the heat is generated in the tissue and not in the instrument, as is the case with the cautery iron.

Certain it is that heat, properly applied in sufficient intensity, and for sufficient exposure, will destroy malignant tissue just as effectively as either radium or Roentgen ray. In heat therapy, however, as in radium and x-ray therapy, complete efficiency has been impossible because the same lack of accuracy has prevailed. Exact dosage directed to the destruction of the tumor on the one hand, and the protection of vital structures on the other, has been lacking. It is with the idea that this defect may be remedied and that heat energy may be used with more nearly complete efficiency that this paper is presented.

In the controlled application of heat which we propose, we are concerned not with the amount of current used, or with the heat of the electrode, but with the actual temperature developed in the tissue. We contend that accuracy of dosage depends solely upon the factor of known heat within the tissue, for exact knowledge of the degree of heat (and the period of exposure) is essential

[2] The first high frequency generator was made by Prof. Elihu Thompson in 1889, and a year or two later he experimented with high frequency currents passing through his own body. In these experiments, he led the current into and out of his body through his hands which were immersed in battery jars filled with salt solution. The first sensation he experienced was warmth in his wrists, where, of course, the current density was greatest.

to the certain destruction of the tumor cells, and the protection from injury surrounding structures. This knowledge we have found it possible to obtain, by implanting small thermo-couples, placed in the tips of hypodermic needles, in the normal tissues around the periphery of the tumor. These outposts constantly record the degree of heat produced in each area, throughout the process of destruction of the malignant growth. All of the thermo-couples placed as recorders of tissue temperature around the tumor, register upon a single millivoltmeter, which we have had calibrated in terms of temperature, instead of units of electricity, so that an observer in charge of the apparatus can at a glance report at any time to the surgeon the temperature engendered in any given portion of the operative field. Applicators containing thermal junctions, which also record upon the temperature-meter are placed in the rectum or vagina for the protection of those structures from too great heat. It should be emphasized that in every instance the temperature registered is that existing in the tissue at the given point, in sharp contra-distinction to those electrodes which have been designed to contain thermometers and which inform the operator only of the degree of heat within the instrument.

We believe that with this method of controlled heat, electrothermy can be employed more efficiently and as a more accurate adjunct to surgery in the treatment of bladder cancer, than has previously been possible.

Concerning the positive electrode to be applied to the tumor surface, it may be said that the various types of flat plate applicators now in use are satisfactory for growths which are very thin, sessile and superficial in character. For the infiltrating carcinomata, however, and for those in which a considerable depth of tumor must be destroyed, an electrode which can be embedded directly into the substance of the growth, is greatly to be preferred. For this purpose we suggest an instrument that we are using with very satisfactory results. It is made in the form of an ordinary wood screw, at the end of an insulated shaft. This is screwed into the tumor, and the sharp threads give ease of introduction with a minimum of trauma, and a larger surface of close

contact with the surrounding tissues. Further, when coagulation is complete, withdrawal of the screw in its long axis, serves as a curette, bringing with it a core of destroyed tumor substance. In large tumors more than one of these electrodes may be embedded at the same time in different areas, thereby reducing the time necessary for complete destruction of the entire mass.[3]

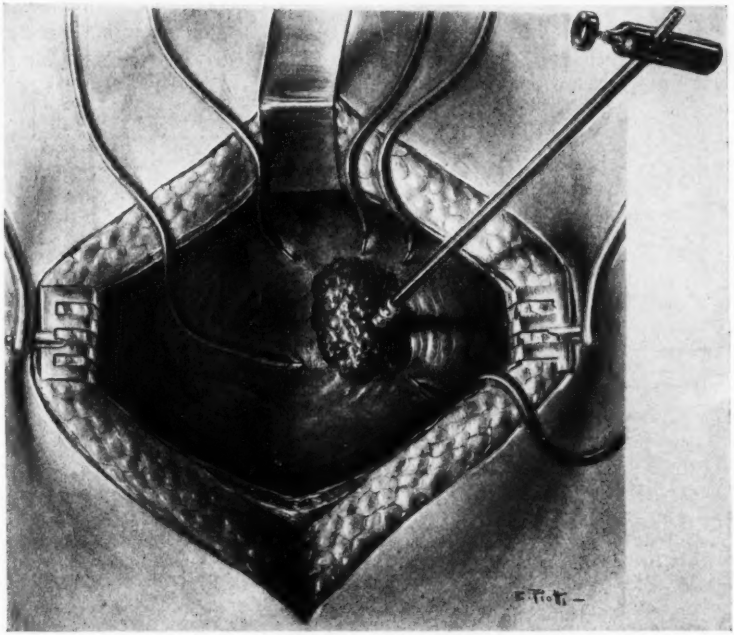

FIG. 1. BLADDER TUMOR, WITH FINE THERMAL COUPLES IMPLANTED IN THE NORMAL TISSUE AROUND THE PERIPHERY OF THE GROWTH
The screw electrode is shown partly imbedded in the tumor substance

We wish to offer this plan of controlled diathermy, not as a radical innovation in method, but merely as an added link in the chain of greater efficiency in the treatment of malignant disease.

[3] This screw electrode, with temperature control, is being used most effectively in the treatment of chronic infections of the endo-cervix. Our results will be described later in a separate communication.

Technical note: The thermo-electric pyrometer, or thermo-couple, consists of two thermo-junctions arranged in electrical circuit with an instrument which may measure either current or electromotive force. The instrument which we have used is a micro-galvanometer and measures current, but it has been provided with a scale calibrated so that it indicates temperatures.

Each thermo-junction is formed by the joining of two dissimilar metals. A number of metals might be used for this purpose. We have used copper and ideal-alloy wires. The two wires may be merely twisted together, soldered, or electrically welded. Electrical welding

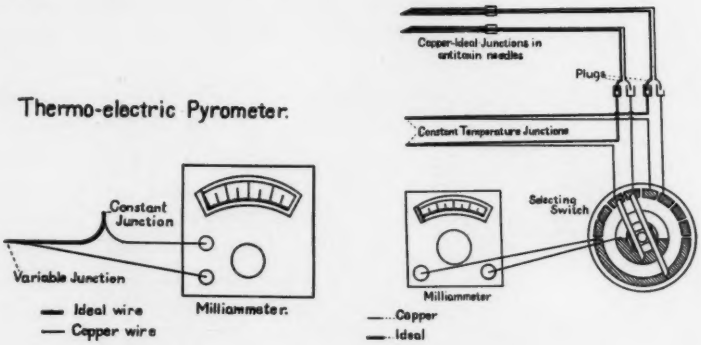

FIG. 2

A. Wire diagram of a thermo-couple in circuit with a micro-galvanometer.
B. Wire diagram of system of multiple thermo-couples in which only two are represented.

makes more permanent junctions. The junctions in this instrument are welded.

The thermo-couple consists of a pair of thermo-junctions joined into an electrical circuit as shown in figure 1.

When two dissimilar metals are joined, there is an electromotive force at the junction, the amount of which is a function of the temperature of the junction. When the metals are arranged in the circuit as shown in figures 2A and 2B, there are two junctions. Each of the junctions is the seat of an electromotive force, but it will be observed that as we pass

around the circuit in any direction we pass from one metal to the other in reverse order, so that the two electromotive forces are in the opposite direction. If the junctions are at the same temperature these electromotive forces exactly balance each other and no current flows through the circuit.

If the junctions are not at the same temperature, then the two electromotive forces do not balance and an electric current flows in the circuit. By measuring this current, or by measuring the differences between the two electromotive forces, one can determine the difference in tem-

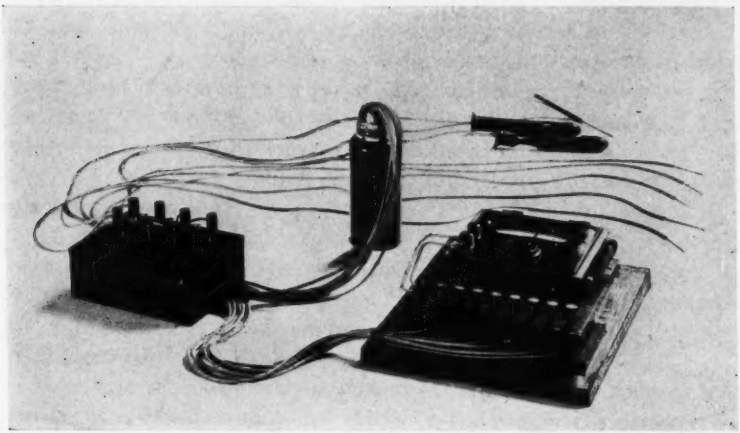

FIG. 3. ASSEMBLED APPARATUS FOR CONTROLLED DIATHERMY

perature of the junctions, and if the temperature of one junction is known, the temperature of the other may also be known.

The variable thermo-junction in this apparatus is formed of fine wires, copper and ideal, which are inserted in the tip of a hollow needle. The constant junctions are placed in a thermos bottle which also contains a mercury thermometer. If the variable junction, the one in the needle, is at the same temperature as the constant junction in the thermos bottle, no current will flow through the circuit and the pointer of the galvanometer will not be deflected. If the temperature of the variable junction is different from that of the constant junction, a current flows and the pointer on the galvanometer is deflected.

Since it is convenient for the surgeon to have several thermo-junctions embedded in the tissues at one time, a plug switch and a selector switch have been included in the circuit so that any pair of junctions can be instantly switched into circuit with the galvanometer. Since the galvanometer has a period of only two or three seconds the readings may be made very rapidly.

DISCUSSION

Dr. JOHN H. CUNNINGHAM (Boston): I would like to say a few words in connection with the description of the apparatus which Dr. Graves has presented.

The determination of the physiological limit of tissue tolerance to heat depends upon the temperature produced in the tissue for a given period of time, and does not in any way depend on the current amperage for a given period of time. In other words, we are not concerned with the temperature of the source of the heat, but we are concerned with the distribution of the heat at the desired point, which is the important feature of this communication.

All the diathermy apparatus now in use that record the temperature, record it in the electrode and not in the tissue, and it is in the tissue that we must get the knowledge that is required to realize whether or not we have gone to the limit of destruction of the growth.

With the thermojunctions placed in normal tissue around the tumor at a distance of 1 cm., which is the distance we choose to put them as a rule, the current is increased in the tissue to a degree of temperature which will destroy the tissue to the point at which our thermocoupler are placed. By maintaining the desired degree of temperature, as recorded by the thermocouple, for the desired period of time we are certain that we have destroyed all tissue between the electrode and the thermocoupler. The estimation of the degree of heat produced in the depth of the growth is estimated by a thermocouple in the rectum or in the vagina.

This method of controlled diathermy we hope will be the means for more accurate knowledge in regard to controlling dosage in diathermy that we may actually destroy the desired area and preserve the surrounding normal structures.

Dr. Benjamin S. Barringer (New York): These two papers have brought up a good many interesting subjects. I think the one of most interest to me is the progress of the control of surgical diseases, especially carcinoma of the bladder. It seems to me there are various ways in which we progress. We perfect one operation, and do it a little faster, so that at the end of the fiftieth operation we do it perhaps ten minutes faster and so save the patient so much shock. We substitute milder major operations for more severe major operations. We substitute minor operations for major operations; and finally, we find in some cases we may be able to do entirely without operation.

It is along these lines that I think we progress, and I would like to say a word in favor of handling cases along this line by radium. We have found that a fair proportion of bladder carcinomata can be controlled by radium without operation. In other words, through the cystoscope.

We have found in other cases that the carcinoma is too large and cannot be controlled in that way; the bladder has to be opened up and an operation performed and radium put in that way.

If any one does grant such a premise—that radium does as well as operation in controlling bladder carcinoma—we have the advantage over operation in that the mortality of the suprapubic opening up is around 2 or 3 per cent, while the mortality of the surgical excision is from 10 to 20 per cent. We immediately have gained from 6 to 16 patients out of 100, not killing them by the operation. That is distinct progress in the control of these cases.

I want to say just a word about Dr. MacKenzie's classification. It is too bad that we cannot all get together, that I cannot have his classification and that he cannot have mine and that each cannot have the other's, so that we have one clean-cut classification.

For instance, Dr. MacKenzie has classified his tumors as carcinoma of the bladder, which is unfair to him and to the carcinomata. There are some carcinomas which are papillary in type, which infiltrate very little, and those are more easily

cured than the infiltrating type which are cured with much more difficulty.

In the infiltrating type of carcinoma, I believe there are two kinds; the type that begins as papillary carcinoma and after a while infiltrates, and the type that begins as pure, flat, ulcerative, infiltrating carcinoma.

I think if we could get a clean-cut simple classification we could all speak the same language.

Just one point about Dr. Graves' and Dr. Cunningham's most ingenious and beautiful device for applying heat to these tumors; they say (and I think rightly) that by heat they cause a destruction of the tumor, very much as you by surgery cause a destruction of the tumor. You go around outside of it, and it is gone. When you apply heat to it, that part to which the heat is applied is destroyed.

I think when you use radium in that sense, you are using it in a wrong sense. Radium does not do that. The man who tries to destroy carcinoma of the bladder or any other carcinoma by means of radium is working along the wrong lines. As I understand it, there are two actions of radium: one, the immediate action upon the cell, and, second, the action upon the vessels. And you get a long drawn out endarteritis and fibrosis, which turns the cancer tissue into fibrous tissue. It is not an immediate destruction at the time you apply the radium. It is quite different from that. I think in a good many cases we know that sclerosis goes on for the course of perhaps a year.

Dr. GEORGE S. SMITH (Boston): We have been endeavoring to influence bladder tumors in the post-operative or in the recurrent stage by the use of a high voltage x-ray at the Huntington Hospital, and it has been rather discouraging to see that really very little could be accomplished. There have been some tumors which have shown signs of a diminution of vitality, if one could judge from the surface appearance of the tumor, but we have had two cases in which full x-ray doses were given (that is, two doses posteriorly and two doses anteriorly) and when at a later period (in one case I think three months, and in another, one month)

the bladder was opened and pieces of these tumors were excised for examination, they showed perfectly healthy tumor tissue with apparently no effect at all from the x-ray.

My feeling is that high voltage x-ray treatment will in certain cases stop the hemorrhage in inoperable recurrences in the bladder, and that it will sometimes reduce the toxicity of the tumor, so that the patient's general condition will improve, but our experience makes us agree with what Ewing wrote when he said that he does not believe any radiation from the exterior of the body will definitely kill cancer cells in the depths of the body. As I recollect what he said, it does not agree with what Dr. Barringer has just said; Ewing said that you influence malignant growths in the body when you use radium, or you should influence them, not by necrosis, but by the influence of the radium on the blood vessels; that he believed the only way in which these tumors could be destroyed was by actually sloughing them out by the insertion of radium into the tumor itself.

If radium is implanted in a tumor of the bladder, either in the form of needles or of seeds, there is going to be a certain amount of necrosis about the radium and other changes at varying distances from it; I think we are bound to get some necrosis.

My feeling is that the way in which we have been using radium in cancer of the bladder, by the implanting of one seed for every centimeter of tumor tissue, has been essentially correct. It seems that the results clinically have been very good, by following that method of treatment, provided you do not try to slough out too extensive a bladder growth.

I cannot agree with Dr. Barringer that the ideal you should aim at is a radiation, which is less intense than to cause actual necrosis. I think one should aim to necrose the tumor as far as the determinable limits, and then beyond those limits you should hope to get the action on the endothelium of the lymph and blood channels, which would form a zone of sclerosis about the growth.

Dr. JAMES A. GARDNER (Buffalo): I just wish to speak in favor of diathermy. Many of us have groped around in the

dark hoping for some method by which we might more successfully attack the cancer problem with less subsequent reaction, less absorption and less sepsis from the necrosis. I have used diathermy on some cases, not all of which have been successful, but it appears that we have found an agent which will aid materially in this class of cases. I am showing two slides. The first case was a very large tumor of the bladder of which fortunately we had a good picture which was taken after simply injecting the bladder with air. Two hours were required to clean out this tumor which must have been as large as a cocoanut. Fortunately spinal anesthesia was used which kept the patient comfortable for an hour and a quarter. Ether was used for the balance of the time. No reaction followed and the patient left the hospital after four weeks. I was much surprised at his uneventful convalescence.

[Slide.] The second slide shows the first tumor that we attacked with diathermy, an infiltrating tumor. In this case, doubtless due to my anxiety to clear it out effectually, the result was exactly what I did not want. Patient had a very marked reaction and died of sepsis six months following operation.

Dr. HERMAN L. KRETSCHMER (Chicago): My difficulty in treating infiltrating carcinomata with diathermy has been to determine whether or not the heat has penetrated deeply enough to destroy all of the carcinoma, and if they have perfected a device which will aid us in this part of the technic, I think it will be a very definite advance in bladder surgery.

I think Drs. Cunningham and Graves are to be complimented on this new procedure in the treatment of tumors of the bladder.

The difficulty in determining the depth to which the heat has penetrated may be illustrated by 2 cases. One patient had a small tumor in the dome of the bladder which we treated with diathermy. The patient died of an embolism four days after he had been treated. Careful histological sections of the bladder failed to show the presence of carcinomatous cells. In the other case where we were dealing with an infiltrating carcinoma the patient was given a thorough treatment with diathermy, after

which he was given some more diathermy for good measure. We felt that we wanted to completely destroy the tumor. This patient died of pneumonia about two weeks after he was operated upon. Autopsy showed that we had destroyed only about one-half of the tumor mass, in spite of the fact that we thought we had given him an excessive amount of diathermy, as we aimed to over-shoot the mark. This, as I see it, is our difficult problem.

It seems to me that is the objection to diathermy because, as we see it now, we cannot control the penetration of the heat; we do not know when it goes deep enough, and unless we do destroy all the carcinoma which infiltrates, our results are going to be as bad with this as they have been with anything else.

Dr. WILLIAM E. LOWER (Cleveland): We are always interested in the problems presented by bladder tumors because they are always with us and we have not made any particular progress as far as the results of treatment are concerned. Therefore when anybody offers a new method of treatment we are naturally very keen to hear more about it.

I should like to ask whether Drs. Cunningham and Graves have had any clinical cases; what degree of temperature they are using; and how they control it, by this new method of treatment.

That heat destroys these tumors is well known, and Dr. MacKenzie's report shows a fairly good number of cases that had been cauterized and were classified as cured.

In going over my own statistics a short time ago I was rather surprised to find a number of cases in which I did nothing more than follow the old method of cauterizing with the soldering iron, and did it very extensively and widely. Among these, 16 cases had remained well for four years and one for seven years. I had not heard from this last case until the patient happened to come in the other day and told me he was entirely well.

It is rather interesting to know that some of these cancers can be cured by a simple method of using heat.

The question of complete dissection of the bladder in cases of tumors is still worth considering in certain groups of cases. If

the ureters can be transplanted simultaneously as Dr. Coffey in a recent publication suggests is possible, then it seems to me the possibility of complete extirpation of the bladder becomes still more promising.

PRESIDENT CHUTE: If there is no further discussion I will ask Dr. MacKenzie to close.

Dr. Smith's remarks on the deep x-ray interested me greatly. For a while we did considerable deep x-ray treatment. Several of our cases were operated on afterwards and the growths removed, and though they all claimed they felt better, dissection of the tissue showed true cancerous tissue with very little effect on it.

Dr. ROGER C. GRAVES (closing): With regard to Dr. Lower's question—we have, of course, used the apparatus and used it sufficiently to demonstrate conclusively that it does what we want it to do. It would be folly, however, at this initial stage of the work to attempt to say anything about clinical results.

Concerning the degree of heat, it is possible to raise high temperatures within the substance of the tumor. Provided you reach a stage of complete coagulation, the temperature is of little moment. The temperature to which normal structures are subject, we have not carried over 50° or 55°, and the temperature of the rectal recorder should not for any considerable period of time, certainly, be allowed to go over 42°C.

I might again just emphasize the fact that we are not holding any particular brief for diathermy as opposed to surgery or as opposed to radium or as opposed to any other method at our command, still, diathermy is a very valuable weapon and it is one that we can make much more valuable by some such means of accuracy as we suggest.

In the past it has been used far too loosely. We have been interested in how much current we have used, with no knowledge whatever of how hot we were or how hot we ought to be. There has been also an utter disregard of the fact that the electrical resistance of the human body is not uniform for all tissues, and

that a given current does not go through all portions of the mass with the same degree of efficiency. Muscle for example conducts the current readily. Fat acts almost as an insulator.

Unless we know, for the given area, first, the degree of temperature in the tissue, and second, the period of exposure to that temperature—we are working on a basis of the greatest inaccuracy. The effect produced must be the product of the two factors of heat and period of exposure to that heat. With the recognition of these facts, controlled diathermy can certainly be made a most effective agent in the treatment of malignant growths.

PRESIDENT CHUTE: Dr. Edward Martin, one of the Honorary Members, has asked us to let Dr. Frank E. Leslie, Associate Director of the Gorgas Memorial, speak to us for a few minutes. If there is no objection on the part of the Society, I will call on Dr. Leslie.

Dr. Leslie presented a prepared paper on the Gorgas Memorial.

PRESIDENT CHUTE: I am sure we are always glad to know how the Gorgas Memorial is going on, and interested to listen to anything in relation to it.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): The classification of bladder tumors according to their gross appearance is not nearly as important as a classification according to the degree of malignancy. The latter factor should be the guide in determining the method of treatment. Broders has shown that malignancy of a tumor depends largely upon the tendency to cellular differentiation. He has found that all tumors can be roughly classified into four grades of malignancy. We have applied this classification to the treatment of bladder tumors and the results have proven its value. Tumors having a malignancy gradation of one or two will respond readily to either fulguration, diathermy or radium, and surgery is seldom if ever necessary.

It is quite different, however, with grades 3 and 4 of malig-

nancy. There it has been our experience that fulguration and radium have been of very little value and that resection, if the tumor is small enough and so situated that it can be resected, offers the best results. When the tumor is too large and can be dissected only with difficulty, then diathermy offers the best method at our command.

However, of fundamental importance is the classification of the tumor according to the method of Broders, which can be done with accuracy in fully 90 per cent of the cases.

INTRAVENOUS THERAPY IN THE TREATMENT OF UROLOGICAL INFECTIONS

HUGH H. YOUNG AND J. A. C. COLSTON

Baltimore, Maryland

Received for publication May 10, 1925

In previous papers we have called attention to the use of mercurochrome-220 soluble intravenously in the treatment of various infections, and have also shown gentian-violet to be successful in certain coccus infections. In 1919 we presented a new germicide for use in the urinary tract (1), mercurochrome-220 and cited numerous local conditions in which it had been employed. In this and later papers we pointed out that the drug was a valuable antiseptic in the urinary tract on account of the fact that it was a penetrating dye, remarkably stable and lasting in its efficiency, little irritating to tissues, comparatively non-toxic and not coagulating albumin or urine. In these and other papers we showed that it could be injected into the blood stream in rabbits in doses up to 10 mgm. per kilogram in the form of a 1 per cent aqueous solution with impunity, and although slight albuminuria and a few casts were present after such doses, the urine rapidly became normal and no permanent damage resulted. A sacrificed animal, which had received 10 mgm./kgm. showed the glomeruli normal throughout, the tubules with a marked swelling of the cells which in many cases practically occludes the lumen and in some places a slight but definite loss of epithelium. Subsequent use in human beings demonstrated that the drug could be used with impunity up to 5 mgm./kgm. and repeated several times. Occasionally at this dose and when doses of 7 and 8 mgm./kgm. were used and repeated, albumin and a few casts appeared, but in all of these cases they disappeared after a few days and no case of permanent renal lesion as a result of mercurochrome, even in large doses, has been encountered clinically.

Our experiments on animals were confirmed by Piper who also gave it intravenously to a woman dying from puerperal septicemia without evidence of injury in doses of 5 mgm./kgm. The first clinical case in which the value of mercurochrome-220 soluble as an intravenous germicide was positively demonstrated, was that of a man, admitted to the hospital on December 30, 1922, complaining of pain in the kidney (case 5 of this series). Ureteral catheterization showed pus from both sides. Following the treatment the patient developed a chill and fever and was admitted to the hospital January 2, 1923, with temperature of 103.4° and in a very toxic condition. On the following day the patient was irrational, temperature high and blood culture showed 140 colonies of colon bacilli to the cubic centimeter. The patient was seen in consultation with the Medical Department, and the diagnosis of general septicemia confirmed, and the patient was thought to be moribund and given four hours to live. At this point we decided to inject mercurochrome intravenously in a dosage of 5 mgm./kgm. per body weight. The patient received 34 cc. of a 1 per cent solution in the vein of thearm. Temperature rose to 104° at mid-night but in six hours had dropped to normal. In a few hours he became rational and the following morning his condition was completely transformed, the temperature was normal, and the patient said that he felt quite well. Subsequent cultures remained sterile and the patient was discharged from the hospital well six days later. Cultures from urine also sterile. In this case, which was the first positive demonstration of the value of mercurochrome as an intravenous germicide against septicemia and urinary infection, the research,which had been commenced six years before, in an effort to produce a new urinary germicide, was concluded. We had originally had the idea of making a compound with phenolsulphonphthalein, which, being eliminated through the kidney, would carry a germicide with it. Although the combination of phenolsulphonphthalein, which Dr. White made in our laboratories failed to secure the desired urinary germicide, the scope of the investigation was widened until some 265 compounds with dye stuffs were made, from which No. 220 was finally chosen as

being the most satisfactory germicide for the urinary tract. Following this positive demonstration of its value in intravenous injections, it was used on other cases.

A woman with bilateral pyelonephritis due to the Bacillus lactis aerogenes was quickly sterilized with a single injection of 5 mgm./kgm.

A young man with an extensive retroperitoneal infection following vesical traumatism was given 27 cc. with a result that the inflammatory mass, which was extensive and fulminating, disappeared within twenty-four hours.[1]

Another early case was that of a child age four with general septicemia following scarlet fever, complicated with a streptococcus sore throat, tonsillitis, cervical adenitis, erysipelas and pyelonephritis. The large dose of 7.5 mgm./kgm. was administered (regardless of the presence of albumin and casts) with a most spectacular recovery. The blood was sterile within twelve hours. All evidence of disease had disappeared within three to four days, and the urine became sterile.[2] These successes, which were reported in successive papers caused various physicians to make use of this form of intravenous therapy, and we soon accummulated a considerable number of cases which had recently been grouped and analyzed in an extensive paper in the Archives of Surgery.[3] Today we will restudy those cases of which we have adequate reports in which mercurochrome-220 soluble has been used in the form of an intravenous injection in cases of infection of the genito-urinary tract and complicating conditions. We will commence with peri-nephritic infections, and then take up in succession, renal, vesical, prostato-vesicular, urethral and other forms of infections.

A. PERINEPHRIC INFECTIONS (4 CASES)

In the 4 cases here cited mercurochrome-220 has proved very effective in combating retroperitoneal and perinephritic infec-

[1] Personal report from Dr. W. E. Stirling, Washington, D. C.

[2] Personal communication, Dr. J. E. Potter and Dr. F. H. Redewell, M.C. U. S. N. since published in the Naval Medical Bulletin, 1925, xxii, 542-553.

[3] Dr. J. E. Potter and F. H. Redewell, M.C. U. S. N.

tions. Case 1 is the first published demonstration of the positive value of mercurochrome-220 as an intravenous germicide in local and general infections (2).

Case 1. Retroperitoneal abscess following bladder instrumentation. Colon bacillus infection. Mercurochrome-220 intravenously, 5 mgm./kgm. Rapid disappearance of abscess.

J. H. D., a youth, aged seventeen, admitted June 21, 1923, had a hypospadias, for which a plastic operation was done to close the defect.

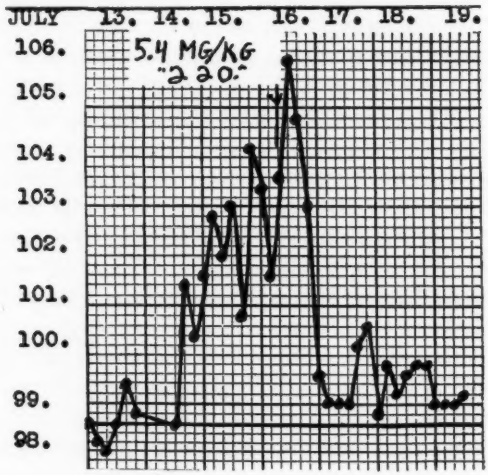

CHART 1. RETROPERITONEAL ABSCESS FOLLOWING BLADDER INSTRUMENTATION. COLON BACILLUS INFECTION

One injection of 5.4 mgm. per kilogram followed by rapid disappearance of sepsis and recovery without operation.

The convalescence was uneventful until July 14, the twenty-third day, when, following the passage of sounds, the patient had a chill and fever which reached 101.5°, as shown in figure 1. On the following day the patient was very ill, and temperature reached 104°. He complained of pain in the left side, extending up the small of his back, and on examination there was muscle spasm and tenderness on pressure. A diagnosis retroperitoneal infection following instrumental laceration of the urethra or bladder was made. On the next day the muscle spasm and mass had increased, and a definite diagnosis of retroperitoneal abscess was made.

The patient's temperature at 8 o'clock was 103.5°. Examination of the urine showed an infection of colon bacilli. Ordinarily the patient would have been taken to the operating room for immediate incision and drainage of the abscess, but we decided to try mercurochrome-220 intravenously, and 27 cc. 1 per cent (5.4 mgm./kgm.) was given 11 a.m. At noon temperature was 106°, and patient had a severe chill, but by midnight it had dropped to 99.6° and after that remained practically normal. For temperature reaction see chart 1. On the following day the patient was free from pain, the muscle spasm had largely disappeared, and he went on to a rapid recovery without operation. June 15, 1924, examination urine sterile.

Remark. The case above detailed, is of interest as being the first recorded case in which a localized infection was cured by intravenous injection of mercurochrome-220.

Case 2. Perinephric abscess (staphylococcus infection). Mercurochrome-220 intravenously 5 mgm./kgm. Gentian-violet 5 mgm./kgm. Recovery.

B. U. I. 12645, W. M. A., male, aged twenty-two admitted Brady Urological Institute, July 24, 1924, complaining of a dull pain of eight days' duration over left renal region. On admission his temperature was 101.6° and his white blood cell count was 17,240. Examination revealed a mass 3 to 4 inches in diameter between the middle of the crest of the ilium and the costal margin. This mass, which extended backward beneath the lumbar muscle, was very tender on deep pressure. On the following day his white blood cell count was 20,000. A double ureteral catheterization showed that neither kidney was infected. The mass was aspirated, pus cells and staphylococci being obtained (culture). A diagnosis of perirenal abscess was made and an intravenous injection of mercurochrome-220 (5 mgm./kgm.) was given. This was followed by severe chill, nausea, vomiting and temperature rose to 103.6°, but by noon the next day it was again normal where it remained until discharge, five days later. The pain had entirely disappeared within twenty-four hours and at the time of his discharge, the mass was not palpable and his white blood cell count had dropped to 8700.

He returned five days later with pain. There was slight muscle spasm and considerable tenderness over left flank, but no mass was felt. His temperature ranged from 99 to 100 and his white blood cell count was 17,240. An examination of the urine showed a staphylococcus

infection. He was given mercurochrome-200 intravenously, 5 mgm./kgm., following which his temperature became normal and the pain decreased in intensity. However, on the next day his condition was about the same as on admission, so he was given 5 mgm./kgm. gentian-violet. Aside from a decided drop in the white blood cell count to 10,120 no change was observed. In view of the persistent staphylococcus infection of the urine he was given hexylresorcinol, 7½ grains three times a day by mouth. His condition gradually improved, the urine becoming sterile, and when discharged two weeks later he was asymptomatic, and apparently well.

Case 3. Dr. J. H. Slaughter, Bogalsua, Louisiana. "Perinephritic abscess." Temperature 103°. Mercurochrome-220 intravenously. 3.5 mgm./kgm. "In two days, mass, tenderness and temperature gone. Cured."

Case 4. Dr. Slaughter. "Perinephritic infection." Severe pain. Mercurochrome-220 intravenously, 3.1 mgm./kgm. Second dose 2.3 mgm./kgm. Fever and pain disappeared. Much improved.

Case 5. Septicemia. B. coli following double pyelonephritis. Patient desperately sick; not expected to live. Mercurochrome-220, intravenously, 5 mgm./kgm. Rapid recovery. Ultimate sterilization of urine.

This case is described at the beginning of this article.

B. PYELONEPHRITIS (26 CASES)

The first successful record (3) of mercurochrome-220 in pyelonephritis is given in case 5 cited at the beginning of this paper. This in fact is the first case in which we succeeded in proving that mercurochrome-220 injected intravenously in the human subject would sterilize an infection. Piper had also tried it but declared, in the report (4) of his cases, "these cases are certainly not definitely conclusive that in mercurochrome-220 soluble we have found a cure for blood stream infection."

Six cases of pyelonephritis are given below in detail in all of which the urine was sterilized by mercurochrome-220 intravenously, assisted by gentian-violet and novarsenobenzol in 2 cases. In 1 case with severe pain and recurrent chills and fever (103 to 105) the disappearance of these symptoms was immediate.

Case 6. Bilateral chronic pyelitis due to Bacillus lactis aerogenes. Mercurochrome-220 intravenously, 5 mgm./kgm. Sterilization obtained.

A woman, admitted to Brady Institute January 2, 1923, complained of pain in the left side of six months' duration, and of frequency of urination. Ureteral catheterization showed pus and bacilli from the right kidney. During the following week the patient was treated by pelvic lavage three times. Cultures were obtained from the right kidney, and were found to be Bacillus lactis aerogenes. Cultures from the left kidney were at first sterile, but later showed bacilli. As the pelvis lavage was unsuccessful in clearing up the renal infection (both 1 per cent meroxyl and 1 per cent silver nitrate had been used), on January 12, she was given an intravenous injection of mercurochrome-220 1 per cent (5 mgm./kgm.). Marked nausea and half an hour later there was vomiting and a large stool. In six hours the patient was comfortable. The temperature remained normal. On the following day the urine was found to contain numerous bacilli (probably dead), but the cultures were sterile. Casts were present for a few days. On discharge from the hospital, January 26, the urine was sterile, a trace of albumin, and an occasional cast. The pain and discomfort had completely disappeared. Subsequent cultural examination showed urine to be sterile, no bacilli present, no albumin, no casts.

Case 7. Pyelonephritis, acute. Mercurochrome-220, and gentian-violet intravenously. Recovery (3).

R. M., aged sixty-three, admitted to Brady Institute June 28, 1923, with tumor of bladder. July 9, resection. September 5, chill, fever, pain, with tender mass in region of left kidney. Continued to have daily pyrexia and rapidly grew worse, until it seemed evident that a fatal ending would soon ensue. Mass in left kidney considerable. Operation contraindicated by desperate condition of patient. September 23, mercurochrome-220 intravenously 5 mgm./kgm. Within three hours bacilli previously present in urine had disappeared completely and Gram positive cocci were greatly reduced in number. Temperature fell to normal and remained so for two weeks. Patient greatly improved. As the urine still contained large numbers of staphylococci and streptococci he was then given novarseno-benzol intravenously 0.60 gram.

Result: slight benefit. October 11, gentian-violet, intravenously, 1 per cent, 28 cc. (5 mgm./kgm.) No reaction. Fever disappeared

and patient continued to improve. Pain and tenderness in region of left kidney disappeared. Urine still contained a few staphylococci. Convalescence satisfactory. Discharged apparently well. December 5, 1923, patient writes that he is entirely well. April 6, 1925, patient well.

Case 8.[4] Pyelonephritis. Staphylococcus. Mercurochrome-220 (3 mgm./kgm.). Urine sterilized. Recovery.

Female, aged forty-five years, admitted April, 1924, complaining of pain in her back, right side, and suprapubic pain, frequency of urination, dysuria and history of frequent pyrexia.

Ureter catheterization showed pus in large quantities on right side with staphylococci on slide smears and cultures. Urine from left side showed pus in small amount and occasional staphylococcus. Pyelogram not done. A general phthalein test, showed practically normal kidney function.

Patient was treated by renal lavage on both sides with 1 per cent silver nitrate, two treatments being given without marked improvement. Patient was then given mercurochrome-220 (about 3 mgm./kgm.) followed by practically no reaction. Temperature became normal, but leucocytes which had previously been 15,000 dropped to 10,000. In about four days the temperature rose and patient was given second injection, same dosage. There was no reaction and injection was almost immediately followed by marked improvement in every respect. Urine became sterile after second injection. It was then clear, free from pus and bacteria on stained specimens. Patient was discharged as cured. She has reported since that time that she has remained well.

Case 9.[5] Pyelonephritis. Staphylococcus aureus. Mercurochrome-220 intravenously 4 mgm./kgm. once and 5 mgm./kgm. twice. Urine sterilized. Recovery.

Male, aged forty-five, admitted about May 1, 1924, complaining of pain, frequency of urination, chills and sweats.

Examination showed tenderness in region of both kidneys and in costo-vertebral angle. Cystoscopy and pyelogram were done. A diagnosis was made of pyelonephritis with contracted pelves (right 1 cc.; left 2 cc.). Phthalein test showed 40 per cent for two hours (30

[4] Personal report from Dr. W. E. Stirling, Washington, D. C.
[5] Personal report from Dr. W. E. Stirling, Washington, D. C.

per cent first hour, 10 per cent second hour). Kidneys were about equal in value. Ureter catheterization showed pus from each side (considerable in amount); many red blood cells. Urine showed an infection with staphylococcus aureus on slides and cultures.

Treatment: Patient was treated 3 times by lavage of the kidney pelves with 1 per cent silver nitrate with marked improvement. Chills subsided, urine became clear and pain was less intense. Two months later he returned with a history of recurrent chills, pain and dysuria. Patient refuses cystoscopic treatment on account of previous experience with pain, etc. It was then decided to give him 20 cc. of a 1 per cent solution of mercurochrome-220 intravenously, the dosage being about 4 mgm./kgm. Temperature rose to 104° and patient had a severe chill. In about an hour patient felt better. Two days later he was greatly improved, but as urine still contained pus and staphylococci another treatment was given (30 cc., 1 per cent). This was about 5 mgm./kgm. The reaction which lasted for thirty minutes was less pronounced, temperature rose to 101°F. Following this the dysuria largely disappeared and patient was much more comfortable and free from pain. The temperature remained normal, but urine contained cocci. Therefore, after four days, was given the third injection of mercurochrome (5 mgm./kgm., intravenously). The reaction was slight with temperature of 100°. At no time after any injection did patient have nausea, vomiting or diarrhea. Urine and sputum were fairly deeply stained with mercurochrome-220. A day or two later examination showed urine to be clear from pus and no bacteria present on slides or cultures. Patient has not reappeared, and physician thinks that this is an indication that he has been cured.

Case 10. Pyelitis due to colon bacillus. A child very septic. Mercurochrome-220 intravenously (8 mm. and 52.5 mgm./kgm.) 4 times. Child's life saved but urine not sterilized.

M. L., a girl, aged four years, weighing 26 pounds (11 kgm.) was admitted to Harriet Lane Home, November 2, 1923, complaining of pain in right side, of two days' duration. The patient was very sick; temperature 102.5°. Abdomen rigid, with marked tenderness over both kidney regions. The urine was cloudy and contained pus and B. coli. During the first two days temperature reached 105°, and on third day patient was very ill, and it was decided to administer an intravenous injection of mercurochrome-220. Accordingly 100 mgm. was given (8 mgm./kgm.). Following injection, temperature fell to 98° (chart 2).

Next day patient was much better, but continued to have a fever, and during next five days received 4 intravenous injections of mercurochrome-220, 30 mgm. each (2.5 mgm./kgm.). Under this treatment temperature finally reached normal on eighth day. She then developed a furuncle. The temperature rose to 102.5°. Bacteria were still present in the urine on discharge.

Case 11.[6] Pyelonephritis. Mercurochrome-220 intravenously 3, 5, 5, 5, 5, 5 mgm./kgm., Culture B. coli. Urine sterilized. Cured.

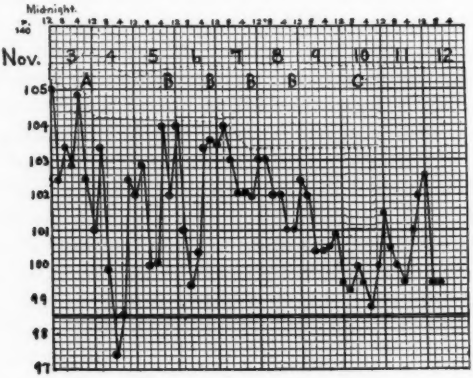

CHART 2. TEMPERATURE IN CASE 10

A, 100 mgm. of mercurochrome (8 mgm. per kilogram); *B*, 30 mgm. of mercurochrome (2.5 mgm. per kilogram); *C*, furunculosis developed but after two days of fever temperature stayed normal.

M. C. G., female, aged eleven and one-half years, admitted April 25, 1923, complaining of frequent high fever which had been present since infancy. Temperature reaching 103°. Diagnosis pyelitis. Fresh specimen showed actively motile bacilli. Culture B. coli. Patient followed several months. Urine always infected, causing a pronounced under-nutrition and poor physical condition. Alkalies, vaccines, and special nutritional treatment tried without success. Neutral acriflavine ½ grain every three hours for three weeks without appreciable result. Hexylresorcinol by mouth 7½ grains three times a day for two weeks without result. Intravenous mercurochrome therapy began October

[6] Personal communication from Dr. Lawson Wilkins, Baltimore.

12, 1924. Injected at intervals of two to three days as follows: 3, 5, 5, and 5 mgm./kgm. Up to this time the urine remained infected. Patient was then given soda bicarbonate 1 dram every four hours, and two days later the fifth injection of mercurochrome 5 mgm./kgm. was given. Urine was strongly alkaline and urine the next day showed no organisms. Two days later six intravenous injections of mercurochrome 5 mgm./kgm. was given, no reaction. The urine was perfectly clear, microscopically negative. It was kept in a bottle without sterile precaution for twenty-four hours and then cultured. No bacteria grew. Urine voided following morning showed distinct fluorescence, no bacteria, no pus. Cultures sterile. Urinalysis November 7, 1924, clear, alk., no albumin, no sugar, no pus. Sterile. Microscopically negative. December 12, 1924, child well. Appetite good, urine clear, no bacteria.

Case 12.[7] Pyelonephritis. B. coli. Chills and fever 105°. Mercurochrome-220 intravenously 4 mgm./kgm. twice. Well.

"Patient, woman, age thirty-five years weight 128 pounds. Three weeks illness with what patient described as la grippe, associated with moderately severe bladder symptoms. Pain on voiding urine, with pus, mucus and blood. This was followed in a few weeks by much pain on voiding with a decided terminal tenesmus and pain in the region of left kidney. After two weeks treatment at home without relief she was brought to hospital. Laboratory findings showed 21,200 leucocytes, polymorphonuclears 89 per cent, blood urea about normal, blood culture negative, vaginal smear negative for gonococcus. Urine showed albumen and pus cells, granular and hyaline casts; colon bacilli. Patient was seriously ill in hospital for twenty-five days with many chills and temperature running from 99 to 105°. Genito-urinary sedatives and antiseptics were used locally and by mouth. For one week she was given hexamethylinamin intravenously twice a day in large doses. All of this was of no avail. On the twenty-sixth day she was given 24 cc. of 1 per cent mercurochrome (4.1 mgm./kgm.). This was repeated the next day with severe reactions, but temperature went to normal and remained so. She was allowed to return home on the 34th day. It is now eight months and she has had not the slightest return of the old symptoms."

Case 13. Dr. T. C. Redfern, Winston-Salem, N. C. Female, adult, admitted with pyelitis; having chills and sweats daily; leucocytosis

[7] Personal communication, Dr. E. B. Walston, Des Moines, Iowa.

22,000. Mercurochrome = 220, 5 mgm./kgm. Temperature 105. "Temperature fell to normal and remained so."

Case 14. Dr. W. C. Stirling, Washington, D. C. Man aged fifty-four years. "Bilateral pyelonephritis. Leucocytosis 28,000. Mercurochrome-220 intravenously twice. Rapid improvement. Urine became free from pus. Patient cured."

Case 15. Dr. Slaughter. Woman aged sixty-five, weight 180 pounds. Admitted January 24, 1924. "Pyelitis. Cystitis. Furunculosis. Arthritis: hips, knees, wrists. Mercurochrome-220 intravenously 1 per cent 20 cc. (3 mgm./kgm.). Severe reaction. Urine cultures became sterile. Arthritis disappeared. "One would have to have seen the suffering of patient to appreciate the wonderful result obtained by mercurochrome-220."

Case 16. Dr. Slaughter. Woman aged fifty-five, weight 135 pounds. "Pyelocystitis" mercurochrome-220 intravenously twice, three days apart. Maximum temperature after first dose 104.2; maximum temperature after second dose 103.6 (dose not stated). Temperature became normal day after the second injection and remained normal. Recovery."

Case 17. Dr. J. E. Little, Fort Smith, Ark. Man aged forty years, weight 157 pounds. "Bilateral pyelonephritis." Staphylococci and B. coli. Mercurochrome-220 intravenously, 1 per cent 30 cc. (4.2 mgm./kgm.). Pronounced improvement. Urine sterile.

Case 18. Dr. C. J. Snitkay, Pell Plaine, Iowa. Woman aged twenty-three years, weight 98 pounds. "Pyelitis. Cystitis. Cultures: Streptococci, staphylococci, B. coli. Daily septic temperature to 105. White blood cell count 28,000. Mercurochrome-220 intravenously 2.2 mgm./kgm.; eight hours later temperature 99.2. Rapid recovery. Urine sterile."

Case 19. Drs. Roeder and Judd, Omaha, Neb. Female aged thirty-four years. Septic temperature for three weeks—101 to 103. "Left pyelonephritis. B. coli in culture. Hematuria. Mercurochrome-220 intravenously, 1 per cent 30 cc. Severe reaction; temperature 106; to normal in twelve hours. Complete disappearance of pain hematuria and urinary frequency. Cured."

Case 20. Dr. E. B. Walston, Des Moines, Iowa. Man aged nineteen years, weight 138 pounds. "Pyelitis. Cystitis. Septic temperature. Cultures: B. coli." Mercurochrome-220 intravenously, 3.8, 3.8, 1.5 mgm./kgm. Rapid recovery. Cured. "Clinically he has recovered entirely." Followed seven months.

Case 21. Dr. Walston. "Pyonephrosis. Woman aged thirty-five years. Fever three weeks, 101 to 105. Leucocytosis 21,200. Urinalysis: albumin, granular casts. Cystitis. B. coli. Seriously ill. Temperature 105. Mercurochrome-220 intravenously 1 per cent twice: 24 cc.; 24 cc. severe reaction. Two days later temperature normal. No return of symptoms. Followed eight months. Cured."

Case 22. Dr. Slaughter. Woman aged thirty-four, weight 140 pounds admitted September 3, 1924. "Pyelitis." White blood cell count 11,000. Mercurochrome-220 intravenously 1 per cent 20 cc. 3.1 mgm./kgm. Vomited, chill, temperature 102.6, diarrhea. "Pain in side disappeared. Next day much improved. Temperature normal. Patient discharged in good condition."

Case 23. Dr. I. C. Case, Atlanta, Ga. Male aged thirty-one years, weight 120 pounds. "Pyonephrosis. Temperature 103.4. Patient in stupor." Mercurochrome-220 intravenously 4.5 mgm./kgm. Temperature 103.4 fell in four hours to 99.5 and patient improved so greatly in strength that twelve days later nephrectomy was done. Recovery. Discharged well thirty-first day.

Case 24. Dr. Little. Female aged fifty-two years, weight 115 pounds. "Pyelitis, double. B. coli. Mercurochrome-220 intravenously 1 per cent, twice (4.7 mgm./kgm.). Slight reaction. Patient much improved and condition cleared up under repeated pelvic lavages."

Pyelonephritis unimproved by mercurochrome-220 intravenously (6 cases)

Case 25. Nephrolithiasis. Pyelitis, acute, suppurative bilateral. Staphylococcus aureus. Mercurochrome-220 intravenously 2 injections without result. Novarsenobenzol, four intravenous injections. Recovery. Sterilization of urine.[8]

[8] Personal communications, Major E. H. Bruns, Chief of Medical Service, Fitzsimons General Hospital, Denver, Colorado. Case M-220 failed; cured by Novarsenobenzol.

"Male, with left nephrolithiasis. Following ureteral catheterization had marked febrile reaction, pus and Staphylococcus aureus in urine. Pain over both kidneys. From this time, May 7, 1924, until July 29, 1924, urine always very purulent. Staphylococcus aureus present. Urotropin in doses up to 80 grains daily without result. Staphylococcus autogenous vaccine, 5 injections without result. Acriflavine pills, 1 grain three times a day without result. July 12, mercurochrome-220, 1 per cent, 20 cc. intravenously, reaction severe. Temperature 103°. One week later mercurochrome-220, 1 per cent, 15 cc. intravenously. Slight reaction. No improvement in urinary findings. About this time a letter was received from Dr. Young advising novarsenobenzol treatment. July 27, novarsenobenzol, 0.45 mgm. intravenously. Urine at this time showed albumin, white blood cells and 60, 800 colonies of Staphlococcus aureus per cubic centimeter of urine. The patient received four intravenous injections of novarsenobenzol every other day, 0.45, 0.60, 0.75, 0.90 gram. No untoward effects until last dose. This was followed by repeated chills, high fever, profuse sweating, photophobia, muscle cramps and pains, stomatitis with foul breath and coated tongue, conjunctivitis, nausea and vomiting, slight icteroid tint of the conjunctiva and slight tenderness over the liver. On the fourth day a generalized maculopapular eruption appeared. Temperature then fell to normal and the patient promptly recovered. Following the second injection of novarsenobenzol July 29, the urine became sterile and the amount of pus cells decreased markedly. Urine remained sterile and by August 6 was perfectly normal. There has been no recurrence of symptoms since.

Case 26. Dr. F. B. Bowman, Hamilton, Ont. "Pyelitis. B. coli. Blood culture negative." Mercurochrome-220 intravenously, 1 per cent, 20 cc., 5 mgm./kgm. Severe reaction. Infection persisted.

Case 27. Dr. Little. "Pyelitis. B. coli. Staphylococci." Mercurochrome-220, intravenously, 4, 4, 4 mgm./kgm. "Results, pain and staphylococci disappeared, bacilli still present in urine."

Case 28. Dr. Frank Hinman, San Francisco, California. "Pyelitis. Ureteral stricture." Mercurochrome-220 intravenously, 1 per cent, 30 cc. "Urinalysis: pus and bacteria still present."

Case 29. Dr. Hinman. "Prostatitis with obstruction. Cystitis. Pyelitis. Culture B. coli." Mercurochrome-220 intravenously, 1 per

cent, 25, 25 cc. "Also vaccines and vigorous lavage. Urine from kidneys and bladder B. coli, heavy growth continued.

Case 30. Dr. Piper. "Pyelitis." Two doses of mercurochrome-220, three days apart (amount not stated). "Symptoms disappeared." Still had pus in urine (4).

C. CASES OF CYSTITIS AND PROSTATO-VESICULITIS

Case 31. Chronic cystitis. Staphylococci and B. coli. Mercurochrome-220 intravenously, 3 mgm./kgm. Cured.

J. M. B., a man, aged sixty, was readmitted October 13, 1923, complaining of frequency of urination. He had been subjected to a perineal prostatectomy one year previously, and a good result was obtained. Examination was negative except for cloudy urine with pus and bacilli present in large numbers. He was treated by intra-vesical irrigations with benefit, but the urine was still heavily infected with colon bacilli and a small number of cocci. October 12, mercurochrome-220 intravenously, 20 cc. (about 3 mgm./kgm.). He had no reaction; no rise in temperature, no vomitus and no stools. Within one hour the urine showed colorimetrically a content of 1:20,000 mercurochrome-220. After the second hour, cultures and slide smears were negative, and remained negative for bacteria until the patient was discharged from the hospital two days later. Cultures obtained ten days later showed that the urine was still sterile. April 30, letter: patient remained well (3).

Case 32. Prostatitis and cystitis. B. coli. Mercurochrome-220 intravenously, 5 times (3 to 4 mgm./kgm.). Urine and prostatic secretion sterilized.

B. U. I. 12929, male, aged twenty-six, weight 200 pounds, admitted October 23, 1924, complaining of chills, fever, pus in urine. Examination showed chronic prostatitis, cystitis, pus and B. coli in urine. Mercurochrome-220 intravenously, 5 doses, 3 mgm./kgm., four days apart, and 2 doses 5 mgm./kgm. at two-day intervals. Aside from slight nausea, patient had no reaction. No red blood cells or casts appeared in urine and both urine and prostatic secretion were sterile on culture and slide smears after the 6th injection. Phthalein test then showed 50 per cent for two hours; before treatment was started, 52 per cent. All symptoms of frequency, urgency and pain disappeared. November 25, prostate normal in size, seminal vesicles slightly indurated. Condition greatly improved. Prostatic secretion shows small amount of pus

cells. No bacteria. Urine negative. Cultures negative. Patient discharged well.

Case 33. Dr. Slaughter. "Acute cystitis." Temperature 104.8°. Mercurochrome-220, intravenously, thrice: 20 cc. followed by slight reaction; 25 cc.; 25 cc. "All symptoms subsided; urine perfectly free from pus."

Case 34. Dr. F. S. Hopkins, Springfield, Mass. Man, aged thirty-nine, weight 170 pounds, urethral stricture. Urethrotomy, suprapubic cystotomy. Staphylococcus infection. Mercurochrome-220 intravenously, 1 per cent, 30 cc., 2 doses. Little effect.

There are a number of cases treated in the Brady Institute in which the intravenous use of mercurochrome-220 failed to effect sterilization. They are given in detail in the chart on reactions (q.v.). As previously stated, this list includes the following: A case of abscess of the seminal vesicle with B. coli and cocci present; the patient died and tuberculosis of the seminal vesicles was discovered; a case of bacilluria, (B. coli); a case of periurethral abscess (B. proteus and streptococci); a case of pansinusitis (pneumococcus, group 4); 2 cases of endo-carditis and septicemia (Streptococcus viridans); a case of peridental abscess; a case of chronic prostatitis (cocci); a case of pyonephrosis (staphylococci); 1 case of generalized tuberculosis, diagnosed meningitis; another case of generalized tuberculosis with severe urinary infection; and a case of pyelonephritis (B. coli, streptococci).

In addition to these there were several cases of colon bacillus pyelitis in which mercurochrome-220 intravenously was entirely unsuccessful. In a few of these cases it was successful, however, as shown elsewhere.

Acute gonorrheal urethritis (26 cases)

Case 35. Acute gonorrheal urethritis. Mercurochrome-220 intravenously, 5 mgm./kgm. Sterilization in twenty-four hours.

B. U. I. 13025. Male aged twenty-three, weight 180 pounds, admitted November 29, 1924, complaining of gonorrhea. Had gonorrhea

five years before and still suffering from persistent urethral discharge. Present attack of one week's duration. Examination shows profuse urethral discharge with marked edema and redness around meatus. The slide smear shows pus cells and intracellular Gram-negative diplococci in large number. Diagnosis: acute gonorrhea. Urine: First glass, pus; second and third clear. November 29, mercurochrome-220 intravenously, 1 per cent, 44 cc. (5 mgm./kgm.). December 1, had very little reaction. Returns today, states that urethral discharge has almost disappeared. Examination shows a very slight mucoid discharge, which was composed only of epithelial cells and occasional leucocytes, but no gonococci. Second injection given, mercurochrome-220 intravenously, 1 per cent, 30 cc. (3.7 mgm./kgm.). December 2, very little reaction. Very little urethral discharge. No gonococci present. December 6, mercurochrome-220 intravenously, 1 per cent, 30 cc., 3.7 mgm./kgm. December 13, slight urethral discharge. No gonococci present. Patient has had chronic urethritis and it is probable that this is keeping up the urethral discharge, but it is thought wise to try one more large injection of mercurochrome-220 (44 cc., 1 per cent solution given today 5 mgm./kgm.). No reaction. December 17, patient has had no return of gonococci in the urethral discharge. Diagnosis old chronic urethritis for which he is receiving local treatment. Result of mercurochrome-220 in this case was simply the sterilize the urethra of gonococci.

Case 36. Acute gonorrhea. Mercurochrome-220 intravenously, 5 doses varying from 2 to 4 mgm./kgm. Disappearance of pus and infection (5).

"A white man, aged twenty-two, admitted to treatment, March 10, 1924, had gonorrhea of sixteen months' duration. There was history of cohabitation with a known infected woman three times since. There was a profuse discharge, showing myriads of gonococci and staphylococci. The kidney functional test gave 225 cc., 35 per cent, in two hours. Five doses of mercurochrome ranging from 2 to 4 mgm./kgm. of body weight were given intravenously daily. There was moderate reactions after all injections. There was an astonishing decrease of pus secretion after the first injection, and gradual diminution thereafter. The absence of organisms was complete after the third injection. Stomatitis developed on the sixth day of treatment, and intravenous therapy was discontinued. Instrumentation and silver nitrate failed to secure any evidence of infection on and after the eighth day. No

other treatment of any kind was given this patient, and he has remained free from any symptoms of gonococcic infection to date, May 3, 1924."

Dr. Whitman has published brief notes on eight other cases of gonorrheal urethritis, acute and chronic, in all of which mercurochrome was used intravenously with a result that the gonococci disappeared, and in all but one case, the urethral discharge left and did not recur. In most cases he used several doses beginning with 2 mgm. and going to 4 mgm., in one case 5 mgm./kgm. and in one case 7 mgm./kgm., with reactions of varying intensity.

Case 37. Acute gonorrhea. Mercurochrome-220 intravenously, 5 doses, 10 to 25 cc., 1 per cent at intervals of two days. Apparently cured.[9]

"J. H. F. Seaman, Second class, admitted to sick list at the Receiving Ship July 18, 1924 with a profuse purulent discharge from urethra in which gonococci were present. Routine 0.25 per cent protargol injections and irrigations were ordered. At the end of four days, no improvement was observed, so all treatment was stopped. Mercurochrome 1 per cent was injected as follows:

	cc.
July 22, 1924	10
July 24, 1924	15
July 26, 1924	20
July 28, 1924	25
July 30, 1924	25

All discharge stopped after he had received five injections, but the urine still contained a few shreds. August 3, 1924, 25 cc. were injected. Patient complained of a mild stomatitis and prickling sensation in fingers. Mercurochrome treatment was stopped. A size 24 French sound was passed, followed by an irrigation of hot potassium permanganate 1:5000 and instillation of silver nitrate 0.5 per cent. August 8, 1924, a size 28 French sound was passed followed by the same irrigation and instillation. August 10, 1924, urine clear and no smear was obtainable. Patient discharged as cured.

[9] Personal report from Lieut. J. E. Potter, M.C. U. S. N. and Dr. F. H. Redenell, to appear in U. S. Naval Medical Bulletin.

Potter and Redewell used the same treatment in 24 case which they tabulated as follows:

All discharges stopped after the following number of injections:

2 cases received 2 injections
5 cases received 2 injections
5 cases received 4 injections
5 cases received 5 injections
7 cases received 6 or more injections
4 cases received 3 or more injections but still had a discharge. Other symptoms were improved

All cases that had five or more injections did not have a recurrence of symptoms, but had a negative smear, following instrumentation and deep instillations of 0.5 per cent silver solution."

Case 38. Chronic gonorrhea, two years' duration. Mercurochrome-220 intravenously 5 doses, 10 to 25 cc. 1 per cent. Apparently cured.[10]

"F. A. Fireman, third class, aged twenty-five. Admitted to sick list at the Receiving Ship, July 19, 1924 with a purulent discharge from the urethra in which gonococci were present. Patient had contracted gonorrhea two years before and has had a chronic discharge ever since (over two years). The prostate was found to be apparently normal. The following treatments of mercurochrome-220, 1 per cent were given intravenously with reactions as noted:

	cc.	
July 20, 1924	10	(no reaction)
July 22, 1924	15	(no reaction)
July 24, 1924	20	(no reaction)
July 26, 1924	25	(mild reaction)
July 30, 1924	25	(mild reaction)
August 3, 1924	25	(mild reaction)

All discharge stopped with fifth injection. Urine contained only a few shreds. Patient complained of headache and malaise after sixth injection, but did not develop stomatitis. August 4, 1924, sounds and 0.5 per cent silver were used and urine still contained a few shreds. August 6, 1924, urine clear. August 8, 1924, sounds and 0.75 per cent silver used; smear negative for gonococcus. On August 20, 1924, was discharged as cured.

[10] Personal communication, Dr. J. E. Potter and Dr. F. H. Redewell, M. C. U. S. N. since published in the Naval Medical Bulletin, 1925, xxii, 542-553.

In all, Potter and Redewell treated 8 cases of chronic gonorrheal infection of the urethra as follows:

1 case received 2 treatments of mercurochrome-220 intravenously
4 cases received 5 treatments of mercurochrome-220 intravenously
3 cases received 6 or more treatments

"All discharge stopped after patients received five or more injections." three cases were cured; 3 cases showed much improvement; 2 cases were not improved.

Case 39. Prostatic abscess. Gonococci. Mercurochrome-220 intravenously, 1 per cent, 4 times, 10 to 20 cc. Disappearance of abscess, discharge and infection.[11]

"L. S. S. Seaman, second class, aged twenty-two. Reported July 17, 1924 complaining of total retention of urine and painful vesical distention. He gave history of gonococcus infection of urethra, first acquired February 20, 1923. He has had frequent recurrences. Examination revealed an enormous prostatic abscess and urethral discharge with gonococci present. The following injections of mercurochrome 1 per cent solution was administered intravenously:

	cc.
July 19, 1924	10
July 21, 1924	15
July 23, 1924	20
July 25, 1924	20

Prostatic massage followed by hot potassium permangante irrigations 1:5000 were also given every other day. All discharge from the urethra stopped after the third intravenous injection, but expressed secretion from the prostate and seminal vesicles still contained 100 white blood cells to the field, and gonococci present. After six injections had been given patient reached mercurochrome saturation and this treatment was discontinued. August 11, 1924, the size of the prostate was greatly reduced although the right lobe was still indurated. August 18, 1924, the prostate was normal in size and consistency firm. Expressed secretion contained only an occasional pus cell. The urine was free from shreds. Instrumentation and injection of a 0.5 per cent silver solution did not produce a return of symptoms nor a positive smear. Patient was discharged as cured."

[11] Dr. J. E. Potter and F. H. Redewell, M. C. U. S. N.

"They have had 11 cases of acute prostatitis which were treated with mercurochrome intravenous" as follows:

1 case received 3 injections
3 cases received 4 injections
3 cases received 5 injections
5 cases received 6 or more injections

One case of prostatic abscess completely cured after 6 injections. One case of prostatic abscess much improved with marked amelioration of symptoms, but still has 50 white blood cells to the field. "All cases showed improvement."

Case 40. Dr. Warterfield.[12] Man, aged thirty-six, chronic gonorrhea, prostatitis, gonococci on slide and culture. Mercurochrome-220 intravenously, 1 per cent, 10 cc. twice; 12 cc. once when prostatic cultures were negative. Then "got drunk," no return of discharge. Nevertheless, mercurochrome-220 intravenously, 1 per cent, 10, 12, and 14 cc. given. Recent cultures sterile.

Case 41. Dr. Whitman. "Chronic gonorrhea. Prostatitis. Gonococci present." Mercurochrome-220 intravenously, 2.5 mgm./kgm., 4 doses. "Stomatitis. Urethral injections for ten days. All tests then negative. Prostate normal. Patient apparently cured."

Case 42. Dr. Whitman. "Chronic gonorrhea. Primary syphilis. Extreme prepucial edema. Multiple chancres of glans penis. Copious discharge, gonococci." Mercurochrome-220 intravenously, 5 mgm./kgm. 2 doses, 4 mgm./kgm. at forty-eight-hour intervals. Gonococci absent after fourth day. "Complete healing of lesions occurred. No evidence of gonorrhea since. No local therapy."

Case 43. Dr. Whitman. "Chronic gonorrhea, gonococci present." Mercurochrome-220 intravenously, 2,4 mgm./kgm. Stomatitis. Treatment stopped. "There was a termination of the discharge and there has been no recurrence." "No supplemental treatment."

[12] Dr. Floyd Warterfield, Muskogee, Okla. Dr. Warterfield reports 7 other cases of gonorrheal infection with various complications—epididymitis, arthritis, etc., with some really remarkable results; these will appear in a forthcoming article in the Journal of Urology.

Case 44. Dr. Warterfield.[13] Man, aged twenty-six, gonorrheal epididymis. Great swelling and pain. Mercurochrome-220 intravenously, 1 per cent, 10 cc. Next day free from pain. Later 23 and 15 cc. given. Secretions became normal. No pus. Followed two weeks, apparently well.

Case 45. Dr. Warterfield.[11] Man, aged forty-five years, acute gonorrhea, epididymitis and adenitis. Mercurochrome-220 intravenously, 1 per cent, 10 cc., 4 doses, 15 cc. were given. Discharge ceased. Swelling rapidly disappeared. Urine clear.

Case 46. Dr. Roeder and Judd. "Gonorrhea, four years' duration." Mercurochrome-220 intravenously, 1 per cent, 31 cc. "Terrific reaction followed by immediate disappearance of discharge for first time in four years. Two weeks later, although discharge had not recurred, was given second injection. Urethral discharge did not reappear. Followed two months."

Case 47. Dr. Walter L. Denny, Baltimore, Md. "Chronic gonorrhea, gonococci present." Mercurochrome-220 intravenously, 5 doses varying from 4 to 5 mgm./kgm. "Discharge and gonococci both disappeared." Also had local treatment. "Final cure." Followed one month.

Case 48. Drs. Roeder and Judd. "Chronic gonorrhea, five years' duration. Prostatitis. Vesiculitis. Epididymitis. Could hardly walk." Mercurochrome-220 intravenously, 1 per cent, 30 cc. "Marked cessation of all signs and symptoms. Abscess of epididymis drained later. Seven days after injection patient was up and about with small morning drop, no gonococci present. Value of mercurochrome-220 in this case cannot be doubted."

Case 49. Dr. Case. "Child aged four. Gonococcus infection. Complete retention of urine. Prepucial abscess. Seen in convulsions. Abscess incised. Five days later mercurochrome-220 intravenously, 1 per cent, 5 cc. (4 mgm./kgm.). Second injection, same dose, five days later. Also local treatment. Complete recovery."

Case 50. Dr. Warterfield.[14] Female, aged thirty-six, acute gonorrheal urethritis and endocervicitis. Temperature 104°. Smears taken

[13] Idem.
[14] Idem.

and diagnosis verified. Gonococci present. Mercurochrome-220 intravenously, 1 per cent, 6 8, 10 cc. General improvement. Apparently got well but not definitely stated.

Case 51. B. U. I. 12917. Acute urethritis, gonococci present, of three weeks' duration. Mercurochrome-220 intravenously, 3 mgm./kgm., 5 times, intervals four to five days. Discharge and gonococci present. No benefit.

Case 52. B. U. I. 12880. Chronic gonorrhea. No gonococci. Prostatitis. Mercurochrome-220 intravenously 2.3 mgm./kgm., 4 doses. 4.6 mgm./kgm., 1 dose. "Pus still present in urine and prostatic secretion, no gonococci." "Result indefinite."

Case 53. Dr. Whitman. "Chronic gonorrhea. Gonococci present." Mercurochrome-220 intravenously, 2.5 mgm./kgm., 3 doses. "Severe stomatitis. Morning drop persisted."

Case 54. Dr. Whitman. "Chronic gonorrhea. Gonococci present. Four graduated doses of mercurochrome-220 given." Stomatitis terminated treatment. Pus discharge persisted. Local treatment resumed for one month. "Cured?"

From the following 4 cases, 3 chronic gonorrhea, 1 acute, and with very small doses of mercurochrome-220, Lavandera (6) argues that mercurochrome-220 is without value.

Case 55. Man, aged thirty-four, chronic gonorrhea, eight years' duration. Arthritis small toe. Mercurochrome-220 intravenously, 10, 14, 15, 18 cc. 1 per cent. Apparently cured. Two weeks later wrote: "Pain in foot, morning drop as before."

Case 56. Dr. Lavandera. Acute urethritis, epididymitis, gonococci. Mercurochrome-220 intravenously, 10, 11, 15, 15 cc., 1 per cent. Stomatitis. Little improvement, gonococci present.

Case 57. Dr. Lavandera. Man, aged nineteen, gonorrhea. Epididymitis. Mercurochrome-220 intravenously, 10, 11, 15 cc., 1 per cent. Reactions. Unimproved.

Case 58. Dr. Lavandera. Man, aged twenty-two, gonorrhea, two years. Prostatitis. Urethral smear negative. Mercurochrome-220 intravenously, 10, 15, 15 cc., 1 per cent, successive days. Unrelieved.

Case 59. Dr. Whitman. "Chronic gonorrhea, twelve months' duration. Gonococci." Four daily doses mercurochrome-220 intravenously, 2 to 4 mgm./kgm. Gonococci disappeared. Morning drop persisted. Mercurochrome-220 and urethral injections. "Cured."

Case 60. Dr. W. A. Whitman (7). "Chronic gonorrhea, gonococci and staphylococci. 4 daily doses of mercurochrome-220, 4 mgm./kgm. "Pus and organisms absent on fourth day. Patient remained free from any evidence of gonorrheal. No other treatment given.

Analysis of gonococcus infections reported

A. Urethritis 26 cases; 12 "cured." In the reports of these 12 cases it is positively stated that the discharge disappeared completely and in most cases that the urine was clear and gonococci absent. In all the reporters considered the disease was eradicated. In only a few cases were provocative injections and cultures from the prostatic secretion obtained. Nevertheless, a clinical cure was apparently achieved in these 12 or 46 per cent of the cases. In 4 acute cases (gonococci noted) the dosage employed was, in 35, 4 doses, 5, 3.7, 3.7, 5 mgm./kgm.; in 36, 5 doses 2.4 mgm./kgm.; in 37, 5 doses from 10 to 25 cc. of 1 per cent solution; in 45, 1 injection 10 cc. and 4 of 15 cc. All were sterilized. In 8 cases, chronic in duration, gonococci were noted in 5 and not in 3. Only No. 46 was said to have been "cured" by 1 injection, 31 cc. 1 per cent. Two received 2 of 5 mgm./kgm. and 2 and 4 mgm./kgm. (35, 43). No. 44 received 3 injections (1 per cent, 10, 23, 15 cc.). Two received 4 injections (41, 2.5 mgm./kgm. each and 39, 10 to 20 cc. 1 per cent). No. 38 had 5 injections varying from 10 to 25 cc. 1 per cent. No. 40, 6 of 10 to 14 cc. 1 per cent. None of these 12 cases received any local treatment. In most of these 12 cases the injections were given intravenously at intervals of forty-eight hours, and, in all but 3, several treatments (3 to 6) were given. In many cases the gonococci disappeared after the first or second mercurochrome-220 intravenously, but additional treatments were given. While it is evident that multiple small doses (2 or 3 mgm./kgm.) may be effective, larger doses are to be preferred. In 5 cases (47, 48, 49, 50 and 60) the reporter states

positively that they were cured, but to be conservative we have classed them as greatly improved, because other treatment was sometimes employed. Large doses (4 to 5 mgm./kgm.) and several injections were generally used. In 9 cases (34 per cent) we have classed the results as failures. Four of these cases (55 to 58) were reported by Lavandera who gave much smaller doses than have usually been necessary (10 to 15 cc. 1 per cent, possibly only 1.5 to 2 mgm./kgm.). Three were chronic cases without gonococci, 1 acute with epididymitis. Four other cases were chronic but with gonococci present; the dosage was small. One acute case of four days duration received 3 mgm./kgm. five times at our clinic and gonococci were still present in discharge.

Résumé. It is apparently proven that gonococcus urethritis may sometimes be rapidly sterilized and all symptoms of disease may disappear after several intravenous injections of mercurochrome-220; but that doses of 4 and 5 mgm./kgm. should be employed to secure results. With smaller doses reactions may be avoided, but the patient may not be cured. In many cases the treatment failed.

It seems probable that gonococci may be eradicated from the tissues and yet live and multiply in the urethra. On this account antiseptic injections should also be employed. In dealing with this dread malady every valuable weapon of offence should be used.

B. Gonorrheal arthritis (12 cases).

Case 61. Gonorrheal arthritis, urethritis, prostatitis. Mercurochrome-220, intravenously twice, 5 mgm./kgm. Recovery.

B. U. I. 12538, F. P., male, admitted to Brady Urological Institute May 29, 1924, with gonorrheal arthritis of three days' duration following an attack of specific urethritis which he had had for one month. On admission the sterno-clavicular, shoulder, knee, tarsal and metatarsal joints were swollen and exquisitely tender, especially on attempted motion. There was also considerable pain in lumbar spine. Temperature 101° and white blood cell count 9600. Examination showed marked urethritis, prostatitis and vesiculitis. Urethral discharge contained many Gram-negative intracellular diplococci.

He was given mercurochrome-220 intravenously, 5 mgm./kgm.

Temperature rose to 103° two hours after injection but was normal next morning, when patient was free from pain in joints, even on motion and pressure. In fact, he walked around the room without the aid of crutches and with but slight stiffness and no pain. Ten days later because of a gradual return of his arthritis, the above dose of mercurochrome was repeated. On discharge, ten days following his last treatment, there was slight pain in the right hip and lumbo-sacral region as well as some stiffness of joints. He was, however, able to walk fairly well with the aid of crutches. The prostatic discharge still contained many pus cells but no bacteria. The urine was also negative for infection. No urethral discharge.

Results: Greatly improved. Report two months later; joints almost normal.

Case 62. Gonorrheal prostatitis and arthritis: Staphylococcus albus. Mercurochrome-220, intravenously twice, 5 mgm./kgm. Cured.

B. U. I. 12474, G. A. W., admitted Brady Urological Institute June 16, 1924. History of recurrent attacks of gonorrheal urethritis. Patient was brought into hospital suffering from marked gonorrheal arthritis of both knee joints and a prostatitis. Both knee joints were definitely swollen and there was a definite limitation of motion. Culture of the urine and prostatic secretion showed Staphylococcus albus.

The patient was given mercurochrome-220 5 mgm./kgm., intravenously. Three days later he had almost perfect function of the left knee joint while the right was greatly improved. Cultures of the urine and prostatic secretion were negative. Twenty-seven days later the above intravenous treatment was repeated and when the patient was discharged six days later he had practically complete function of both knees. His urine and prostatic secretion remained negative. Cutures sterile.

Case 63. Acute gonorrhea with arthritis involving left knee. Mercurochrome-220 intravenously, 5 cc., 1 per cent daily, after second day 10 cc., 7 in all. Excellent result.[15]

B. U. I., male, aged twenty-four, weight 200 pounds. Acute gonorrhea of three weeks duration, arthritis of left knee of four days' duration. Knee tremendously swollen, painful, motion considerably limited, nocturnal temperature of 100°. Acute urethral discharge, showed gonococci on culture. Urine cloudy with pus. Mercurochrome-220

[15] Personal communication of Dr. W. A. Frontz.

intravenously, 1 per cent, 5 cc., following day a slight improvement; third day mercurochrome-220 intravenously, 1 per cent, 10 cc. and after that daily injections of 10 cc. (1.1 mgm./kgm.). After eight days gradual but extraordinary improvement in knee-joints, now only slightly larger than normal, still showed small amount of fluid in periarticular tissues, motion complete without pain. Temperature normal. Urethral discharge completely disappeared.

Case 64. Gonorrheal arthritis of knee. Mercurochrome-220 intravenously 5 mgm./kgm. Recovery.[16]

G. R., aged twenty-five years, weight 120 pounds, while hunting stuck a cactus needle into left knee joint. This was followed by swelling of the joint which lasted three days. Two weeks later acquired acute gonorrhea. Gram-negative diplococci present in abundance. Six days later knee again became swollen and very painful and he began to have fever. On admission temperature was 102, white blood cell count 12,000. Knee greatly swollen (size of a grapefruit,) pain excruciating. On the sixth day after entrance, swelling and pain being very great, mercurochrome-220, 5 mgm./kgm. (25 cc., 1 per cent) intravenously at 10:30 a.m. Severe chill, vomited twice, temperature 104°. At 2:30 p.m. delirious, temperature 106.5°. At 3:30 p.m., consciousness returned, temperature 106.5°. Pain in knee less. At 6 p.m., temperature 104°, began to sweat, bowel movement stained red. 7:30 p.m. Temperature normal. Patient felt excellent. No pain in knee. During next four days temperature was normal and pain in knee had completely disappeared, but swelling persisted. On the tenth day patient was able to move knee and on the fifteenth day was out of bed and apparently well.

Case 65. Gonorrheal arthritis. Mercurochrome-220 intravenously, 7 injections of small dosage. Disappearance of arthritis and urethral infection.[17]

Male, aged twenty-nine, weight 150 pounds, exposed June 27, 1924. On June 30, noticed urethral discharge and used 10 per cent argyrol. On July 3, examination showed a profuse discharge containing many

[16] Personal report of Dr. J. Ferrer, San Juan, Porto Rico.

[17] Dr. Floyd Warterfield, Muskogee, Okla. Dr. Warterfield reports 7 other cases of gonorrheal infection with various complications—epididymitis, arthritis, etc., with some really remarkable results; these will appear in a forthcoming article in the Journal of Urology.

intracellular Gram-negative diplococci. Penis much swollen, enlarged lymphatic glands. Treatment with hot fomentations. July 5, right elbow joint became swollen. July 6, temperature 101.5°. Great pain in elbow joint and increase of swelling, profuse urethral discharge. Mercurochrome-220, 10 cc., 1 per cent solution intravenously, (1.4 mgm./kgm.). Severe diarrhea. By third day pain entirely gone and swelling of elbow greatly reduced. At that time I decided to give him a second dose of mercurochrome-220, but owing to severe reaction he would not consent. On the night of July 10, his right knee became involved. He had to be assisted to my office owing to severe pain in knee, and elbow. He was more than willing for me to give him some treatment, so I gave him mercurochrome-220, 1 per cent, 12 cc. intravenously (1.7 mgm./kgm.). On July 13, he walked into the office unassisted, comparatively free from pain. I gave him the same treatment, mercurochrome-220, 1 per cent, 12 cc. intravenously—hardly any reaction. Three days later another injection mercurochrome-220, 1 per cent, 12 cc., intravenously, with no reaction. On July 23, mercurochrome-220 intravenously, 1 per cent, 12 cc. July 26, mercurochrome-220 intravenously, 1 per cent, 14 cc., July 29, mercurochrome-220 intravenously, 1 per cent, 14 cc. No reaction following the last three doses. The urine began to improve and by the 16th was absolutely clear and remained so until August 1, when slight discharge appeared, containing a few Gram-negative diplococci. By August 8, urine was again clear and has remained so, all signs of infection having disappeared."

Case 66. Gonorrheal arthritis, acute. Mercurochrome-220 intravenously, 4 doses, 10 to 20 cc., 1 per cent. Discharged as cured.[18]

"E. L., aged twenty-six. Italian laborer. Admitted to genito-urinary clinic, University of California, July 24, 1924. Complaint of rheumatism and acute gonorrhea which he acquired six weeks prior to admission. Smear positive for gonococci. No urinary symptoms. Examination revealed gonorrheal rheumatism in right wrist joint, which was much swollen and very painful. Wasserman negative. Treatment: Hot irrigations, partargol injections 0.5 per cent twice daily. Condition did not improve.

July 28, 1924, received 10 cc. 1 per cent mercurochrome intravenously
July 30, 1924, received 15 cc. 1 per cent mercurochrome intravenously

[18] Personal communication Dr. J. E. Potter, M.C. U. S. N. and Dr. F. H. Redewell.

August 1, 1924, received 20 cc. 1 per cent mercurochrome intravenously
August 4, 1924, received 20 cc. 1 per cent mercurochrome intravenously
Severe reaction.

August 5, wrist joints show much improvement and have become movable without much pain. All discharge from urethra has stopped. Urine contains shreds. Mercurochrome treatment begun again. August 9, 15 cc., 1 per cent solution intravenously. August 11, 15 cc., 1 per cent solution intravenously. August 12, urine clear; wrist joints freely movable, normal in size and without pain. Discharged as cured August 24, 1924.

Comments. There have been 4 cases of acute gonorrorheal rheumatism treated with intravenous mercurochrome. One case received 4 injections and was much improved; 1 case 5 injections, much improved; 2 cases, 6 or more injections, cured. Of all the cases treated with mercurochrome the most striking results were those obtained in patients suffering with acute gonorrheal rheumatism" (Potter and Redewell).

Drs. Potter and Redewell also reported 12 cases of epididymitis and seminal vesiculitis, 40 cases of chronic prostatitis, 30 cases of chronic myalgia, 2 cases of cystitis and 8 cases of synovitis in which good results were obtained by mercurochrome intravenously. We have not space to record these interesting cases. Their conclusions are: "Acute rheumatism, synovitis, myalgia, neuritis, arthritis, acute gonorrheal urethritis, epididymitis, prostatitis, and seminal vesiculitis cases will clear up rapidly on the intravenous administration of mercurochrome-220 soluble, in a large number of the cases." (The present writers would prefer to be a little more conservative.)

Case 67. Generalized gonorrheal arthritis; very severe case. Prostato-vesiculitis. Mercurochrome-220 intravenously, 2 per cent solution, 4 doses, 200 to 400 mgm. each. "Cure."[19]

Adult male, with gonorrhea twice in ten years. Developed gonorrhea again about one month ago (July, 1924). A severe general arthritis came on involving feet, ankles, right hip and elbow. There was a discharge from the urethra. Prostatic examination showed a large boggy

[19] Cited in report of Dr. C. D. Allen, Memphis, Tenn.

tender prostate, typical of gonococcus infection. Repeated laboratory reports failed to demonstrate presence of gonococcus, but history clearly indicated the disease. The patient received intensive treatment with mercurochrome intravenously, under which all of his symptoms have subsided. He received in addition to other treatment four doses of mercurochrome intravenously, 2 per cent solution 300 to 400 mgm. per dose. Doses were given five to seven days apart. He left hospital walking easily, wearing a pair of shoes; a feat he had not been able to perform in three or four months.

Dr. Allen presents the following analyses of cases treated with mercurochrome intravenously.

Of the 68 gonorrheal cases, three were unimproved and 65 were improved. By improved we mean more rapid and more pronounced improvement than could be expected under ordinary treatment alone. In fully 50 per cent of the 68 patients, any discharge present rapidly disappeared. Five of the 68 patients had gonorrheal arthritis, 1 case extremely severe; the other 4 mild. The four last mentioned secured immediate relief of pain from the first injection; the severe one after the third injection. All 5 had failed to respond to the usual treatment alone.

"Three of the 68 gonorrheal cases were women. One had pus tubes, pelvic peritonitis, cystitis, Bartholin abscess—in fact, the whole unfortunate picture seen in such cases. The other had a Bartholin abscess and cystitis. Both were married women who had contracted this disease innocently from their husbands. One of them received three doses; the other two; one dose of which was 800 mgm. Both were free from discharge two days after the first injection; the cystitis had subsided. The Bartholin abscess had not only ceased to drain, but was painless and healing. After the second dose in each case it was impossible to find any evidence of gonococci in smears from any portion of the genital tract. In the one with pus tubes, all evidence of infection subsided; the uterus was freely movable, and no lateral mass felt. Both patients felt fine and had ravenous appetites. In the third case, the patient had a pelvic peritonitis and bilateral pus tubes."

"She received one injection on December 29 of 160 mgm.

From this she had a moderate reaction. The next day nearly all of her pelvic pain had disappeared, and the temperature was down. There were several irregular rises of temperature during the week, but the nausea had ceased entirely in five days, and the patient was beginning to eat well. On January 6, the patient was given 340 mgm. of mercurochrome. There was no pelvic pain, and the abdomen could be handled without eliciting any tenderness. No vaginal examination was made at this time as the patient was menstruating in a normal manner without pain or discomfort. The second injection caused no reaction. The temperature is normal and appetite is good. It is too soon to say what the ultimate outcome will be, but the patient is at least improving."

Case 68. Dr. Warterfield.[20] Acute arthritis, gonococci present. Arthritis, right sternoclavicular articulation and right shoulder joint seriously involved. No urethral treatment. Mercurochrome-220 intravenously, 1 per cent, 10 cc., 5 times. "Arthritis and urethritis disappeared completely. Returned to work on the sixteenth day apparently cured.

Case 69. Acute gonorrheal arthritis. Mercurochrome-220 intravenously, 4 doses. "Cured."[21]

"J. H., male, white, eighteen years of age, admitted with acute gonorrheal urethritis. Given local treatment to use at home. On February 2, 1924, returned with the right sternoclavicular joint very much swollen, very tender, painful and somewhat boggy. Right shoulder joint also seriously involved. He supported his arm in a sling and was unable to move shoulder without very severe pain. Temperature 100°. Was given 10 cc. mercurochrome-220 intravenously, 1 per cent. Reaction moderate: nausea and copious stools. The next morning was free from pain and could use his arm. Two days later he returned for the second treatment. He had discarded his arm support and was free from pain and swelling had begun to subside. Mercurochrome-220 intravenously,

[20] Dr. Floyd Warterfield, Muskogee, Okla. Dr. Warterfield reports 7 other cases of gonorrheal infection with various complications—epididymitis, arthritis, etc., with some really remarkable results; these will appear in a forthcoming article in the Journal of Urology.

[21] Idem.

10 cc., 1 per cent. Reaction slight. February 14, mercurochrome-220 intravenously, 10 cc., 1 per cent. February 17, mercurochrome-220, intravenously 12 cc., 1 per cent. No reaction. By this time the tenderness, swelling and urethral discharge had disappeared and he returned to work on February 18th and has had no return of either urethral discharge or the articular swelling or pain.

Case 70. Dr. Warterfield.[22] Male, aged twenty-nine, acute urethritis, gonococci present. Arthritis, elbow and knee. Very severe. Mercurochrome-220, intravenously, 1 per cent, 10, 12 cc., thrice, 14 cc. twice. Ultimate cure. Urethra sterile, no discharge.

Case 71. Drs. Reed and Lum. Man, aged thirty-nine, chronic urethritis, prostatitis, arthritis, multiple. Mercurochrome-220 intravenously, 1 per cent, 30 cc., tenth day 30 cc. "Clinical improvement was very satisfactory," no definite facts.

Case 72. Dr. Warterfield.[23] Man, aged thirty-two, chronic gonorrhea, prostatitis, multiple arthritis. Gonococci present. Mercurochrome-220 intravenously, 1 per cent, 25 cc. Very severe reaction. Following day free from pain. Second injection advised but refused.

D. CHRONIC CHANCROIDAL ULCERATIONS (4 CASES)

The next case is a very remarkable demonstration of the effect of mercurochrome-220 on severe skin infections. The case was one of those chronic phagadenic chancroids which often go on to progressive destruction of the entire penis.

Case 73. Chronic chancroidal ulceration, extremely painful. Mercurochrome-220, intravenously 5, 5 and 4 mgm./kgm. Cured.

B. U. I. 12056, R. F. B., male, aged twenty-eight admitted to Brady Urological Institute, January 11, 1924, complaining of sores on penis of six months' duration. The ulcers had been treated in various clinics where x-ray, nitric acid, tartar emetic and numerous other forms of therapy had been tried and failed. Examination revealed an ulcer 1 cm. in diameter on dorsal portion of corona and a large, dirty, chronic ulcer about 3 mm. deep and 1 cm. broad which covered whole left side

[22] Idem.
[23] Idem.

of penis behind corona. The ulcers were excruciatingly painful and morphia was necessary. Temperature moderately elevated; white blood cell count 13,200. Wassermann negative. After all local antiseptics had failed ulcer on corona was cauterized and the lateral ulcer completely excised by means of cautery knife. Circumcision was also done. Pathological study of tissue removed showed chronic inflammatory tissue. Within a week the entire wound had broken down and the same inflammatory process had again started, accompanied by great pain.

Cultures from the wound revealed Gram-positive cocci, B. pyocyaneus and Gram-negative bacilli. February 21, gentian-violet, intravenously 5 mgm./kgm. No reaction. No improvement in ulcers, nor in pain. Patient's condition really desperate—openly threatening suicide. It was decided to try mercurochrome-220. February 26, mercurochrome-220, intravenously, 5 mgm./kgm. Reaction: Temperature 104°. Chill, nausea, vomiting, but no diarrhea. Within two hours the pain began to decrease in intensity and the next day for the first time he was free from pain, and the serpiginous ulcer looked cleaner. February 28, mercurochrome-220 intravenously, 5 mgm./kgm. Reaction: No chill, temperature 100.8°, slight stomatitis, no nausea or stools. Urine: Faint trace of albumin, a few casts. From that time on his wound improved markedly and healthy granulations started to form. March 12, mercurochrome-220 intravenously, 4 mgm./kgm. No reaction. March 13, urinalysis negative for albumin and cats. Wound healing steadily. March 30, patient discharged. Condition excellent. Wounds healed, no pain. No morphia taken. Urine negative.

Two similar cases are reported by Dr. C. A. Allen.[24]

A female (case 74), whose fourchette was studded with chancroidal ulcers, had a deep ulcer on the right labium, three ulcers about the anus, and a beginning inguinal adenitis. The dark field examination was repeatedly negative. She could hardly walk on account of pain. Mercurochrome 200 mgm. was given intravenously. Pain disappeared the next day. The ulcers healed, the adenitis subsided and she had no further trouble.

The 2 other cases (75 and 76) had buboes following a chancroid on penis. The disease was spreading in spite of everything that could be done. The patients were miserable from the pain.

[24] Cited in report of Dr. C. D. Allen, Memphis, Tenn.

The buboes had been opened and the surrounding skin was red, infiltrated, and studded with small chancroids. One patient received one dose 300 mgm. mercurochrome and the two other doses of like amount a week apart. There was immediate cessation of pain and spreading. Healing took place and they made an interrupted recovery.

ANALYSIS OF RESULTS

Perinephritis. In the four cases of perinephric abscess the results were apparently uniformly good and in our two cases very striking, especially in No. 1, where a large inflammatory

TABLE 1

Infections of genito-urinary tract (except gonorrhea)

Results of mercurochrome, intravenously, 35 cases

GROUP	DIAGNOSIS	TOTAL	"CURED" OR STERILIZED BY MERCURO-CHROME 220	GREAT IMPROVE-MENT AFTER MERCURO-CHROME 220	FAILURE
A	Perinephritic and retroperi-toneal cases	4	2	2	
B	Pyelonephritis	23	10	7	6
C	Cystitis and prostatitis	4	3		1
D	Chancroidal ulceration	4	4		
Totals.....		35	19	9	7

mass disappeared quickly. The total number of cases, however, is still too small for definite conclusions. In 1 and 2 the dosage was 5 mgm./kgm., in 3, 3.5 mgm./kgm. and in 4, 1 and 2.5 mgm./kgm. (see table 1).

Pyelonephritis (23 cases). In 7 cases the urine was sterilized and the patient relieved of all signs and symptoms.

Summarizing: In B. coli pyelonephritis, 6 were sterilized, and 3 were not. In 6, organism not stated, B. coli was more probably present, 3 "cured," 3 not sterilized. In 5 cases with staphylococci present all were sterlized. The B. coli cases are thus shown to be variable in results: this corresponds to the great variation in

resistance shown by Miss Hill in an exhaustive study of 150 strains of B. coli.

Among the "improved" cases are some which were finally sterilized by pelvic lavage. It seems probable that bacteria growing in the urine or urethra may not be reached by intravenous drugs in some cases and may require antiseptic lavage of the urinary reservoirs to sterilize them.

With eradication of the primary focus of infection, pelvic lavage and intravenous mercurochrome we believe the great majority of pyelonephritis cases can be sterilized. Combined treatment is, therefore, indicated.

Gonorrheal arthritis. Among the 12 cases of gonorrheal arthritis here recorded, in 5 the results are apparently cures—complete disappearance of the arthritis and initial infection. (These cases are shown in table 2.) As seen here, gonococci

TABLE 2

Results of mercurochrome, intravenously, in 42 cases

GROUP	DIAGNOSIS	TOTAL	APPARENTLY CURED	IMPROVED	FAILED
A	Urethritis and prostatitis	26	12	6	8
B	Arthritis	16	13	3	

were found in three, staphylococci in one, and in one case the organism is not stated.

Four cases (61, 63, 64, 65) may be classed as greatly improved. Gonococci were present in all in the urethral smear. Case 61, with arthritis in the sternoclavicular, shoulder, knee and tarsal joints, had almost complete disappearance of arthritis. The urethral discharge disappeared and the urine became sterile after two doses of 5 mgm./kgm.

These cases of multiple arthritis, non-gonorrheal in origin, are too few to warrant our drawing sweeping conclusions. The improvement, however, that came from injection of mercurochrome intravenously was very striking in 4 cases. The disappearance of swelling, pain and restriction in motion in joints in some of these cases was indeed very extraordinary and in some

the relief was apparently permanent. The dosage varied but was always multiple. Very interesting arthritis cases described most fully under other lesions are cases 57 and 58.

In the treatment of gonorrhea and its complications, the recorded experiences are still too meager to warrant positive deductions. There have been many failures, generally due, we believe, to insufficient treatment or to the early development of reactions which prevented continuation of treatment. Where the patient has been able to take a full series of fairly large doses very definite sterilization of the local lesion and pronounced effect upon the complications has undoubtedly occurred in some cases. Too much cannot be expected in chronic gonorrhea associated with lesions of long standing, strictures, ulcerations, prostatitis, etc. Even though intravenous therapy is employed one is not justified in not using in addition well tried old methods; and some of our experiences would seem to indicate that gonococci and other bacteria may remain in the urethra or other urinary passages after having been eliminated from the tissues, so that local treatment may be absolutely necessary to produce sterile cultures.

The records cited in other papers are definite in showing that in such diseases of the skin as erysipelas, furunculosis, cellulitis and infections of the soft parts, including abscesses, really astoundingly rapid clearing up of the infectious process often follows intravenous injections of mercurochrome-220. In arthritis, the disappearance of pain, swelling and limitation of motion has in some cases also been extremely striking. Under the septicemia group we have recorded 24 really amazing recoveries and in pneumonia, particularly in children, a limited number of really striking results have been cited.

Freeman and Hoppe seem justified in the claim of having reduced the mortality in pneumonia in children from 39 to 8 per cent in a series of 46 cases, if the results here recorded are borne out. In the future, really considerable lowering of the mortality rate in certain types of pneumonia may occur. Pneumonia due to streptococcus hemolyticus seem to be more amen-

able to the treatment, but we have records also of pneumococcus cases.

In arriving at a correct estimation of any form of therapy great difficulties are always encountered—such has been the case here, but we have endeavored by diverse classification, studying groups and numerous tabulations, to present all the facts. In therapeutics it is so easy to confound propter hoc with post hoc and also so easy, in the enthusiasm of a new idea, to view facts in a biased way that the exact truth is difficult to get. Realizing these things, we have endeavored to be on the safe side, and, as stated above, we have plainly stated and tabulated the facts and those who are interested will find considerable material for study and independent judgment.

Technique. We have recommended (and it has usually been followed) the injection of a 1 per cent solution made up with freshly distilled water from the granular form of "mercurochrome-220 soluble." Warm water may be used in making this solution, but it should not be boiled as disintegration may occur if the fluid is super-heated. In the adult, the injection is made as a rule in one of the veins at the bend of the elbow but other veins may be employed. In children and adults with very small veins the external jugular or a vein of the thighs may be employed and in infants the peritoneal cavity may be injected. We have never seen evidences of irritation of the vein or thrombosis in any of our cases with mercurochrome. In a case of gentian-violet, which in a 1 per cent solution is extremely thick, 0.5 or 0.25 per cent solution is preferable. In our early papers we advised the full therapeutic dose, 5 mgm./kgm (22.5 cc. of a 1 per cent solution per 100 pounds of body weight) and in the majority of cases here recorded this dosage has been used. In a few instances it has been exceeded, 7 and even 8 mgm./kgm. in succession having been employed in children. In some instances the dose has been much smaller and we believe that many of the negative results herein recorded are directly due to the smaller dosage and the consequent inefficient treatment employed. We believe also that many cases would have done

better if two or more injections of even 5 mgm./kgm. had been administered, but on the other hand a few remarkable results have been obtained by multiple small doses.

Reactions. In rare instances, even large doses, 5 mgm./kgm. or over, have been followed by little or no reaction, but in most cases there is a definite and often very pronounced reaction, consisting of an immediate slight depression, a feeling of discomfort in the upper abdomen and perhaps a slight headache, followed shortly afterward by nausea, slight or pronounced, and a little later by bowel movements, which, however, are often absent. In febrile cases there is a rise in temperature varying from 1 to 5° which usually comes on within three to four hours after the injection. In some cases this is accompanied by a chill which is rarely very severe. In one case a temperature rise to 107.5° was recorded and the patient recoverd. The initial rise in temperature is almost always followed by an early and very profound drop, not infrequently to normal or nearly so (see charts 1 and 2). In rare instances there is a fairly profound shock following the injection and cases are recorded in which the pulse has become very bad, the patient cold and clammy and the shock so severe that restoratives were immediately required.

While no definite statements can yet be made as to the nature of these febrile reactions or their importance in a cure, it is our impression that those cases in which a pronounced febrile reaction occurs are much more apt to get a favorable response and ultimate sterilization after intravenous injections of mercurochrome.

The gastro-intestinal reactions are often very annoying and sometimes acutely distressing but they rarely last more than twenty-four hours and in our long series of collected cases no evidence of any permanent injury has been found. Stomatitis is a much rarer complication and only occasionally has been more than slight. In a few recorded cases a very pronounced stomatitis occurred and in one of our cases the patient suffered a good deal for about one week. Here again the reaction was never dangerous or permanent in its injury.

There has been discussion in certain quarters about the danger of mercurochrome to the kidneys. Before beginning the use of the drug even locally, knowing that we were dealing with a mercurial, great pains were taken by animal experimentation to determine at what dosage the drug could be used with impunity. As recorded elsewhere we have shown that animals can tolerate repeated doses of 5 mgm./kgm. and generally doses of 10 mgm./kgm. without injury to the kidney more than a transient albuminuria, and possibly a few casts. In a collection of over 250 human cases these experiments have been verified and in five autopsies upon patients dying from septicemia, who had received mercurochrome without avail, the pathological department of the Johns Hopkins Hospital has reported to us officially, that they found no evidence of injury due to mercurochrome, either in the kidneys, intestines or other organs. This will be dealt with at length elsewhere. As a matter of fact, in many of the cases here recorded, albumin, casts, pus cells and impaired renal function were present to indicate a definite nephritis before the mercurochrome was given, and in most cases we have seen these conditions improve or completely disappear after intravenous mercurochrome. We, therefore, feel on perfectly safe ground in stating that this drug may be used intravenously without fear of real injury to the kidneys. Our only fear is that timidity, resulting from the false reports which have been circulated may cause physicians to use doses utterly inadequate to combat the severe and fulminating infections which might otherwise be greatly benefited or cured by intravenous injections of this drug.

The use of gentian violet and novarsenobenzol is occasionally very helpful in coccus infections. Cases are cited which did not become sterile until one of these was used. Generally speaking, mercurochrome is much the better intravenous germicide, even in Gram positive cocci, and should be used first and repeatedly, but then in case of failure, or stomatitis the other two drugs may be tried.

Conclusions. While there have been many failures in the 76 genito-urinary cases recorded here in which mercurochrome has

been used and in others only slight improvement, particularly in the acute simple gonorrheas, nevertheless the undoubtedly good results obtained in the great majority of cases cited are sufficient to warrant an extended use of this new form of therapy in urology. In acute infections of the genito-urinary tract associated with high fever, the most pronounced results have been obtained, both in infections due to the cocci and the bacilli. In chronic afebrile infections of the urinary tract, particularly those due to the Colon bacillus, often the results have been negative, but here again some brilliant sterilizations have occurred. In the staphylococcus and streptococcus infections the results have been more uniformly successful and the same has been true with the metastatic complications of gonorrhea. In simple gonorrhea of the urethra the assistance of antiseptic injections has been necessary to effect a cure in most cases.

While admitting the failures and being unable to explain the raison d'être of many of the striking results obtained, we feel sufficiently assured to state that in this form of therapy a most important addition has been made to urology which is worthy of a much more extensive usage.

NOVARSENOBENZOL

This drug is a condensation product of the salvarsan base with sodium formaldehyd sulphoxylate. It was shown by Janét and Levy-Bing to be useful in cases of gonorrheal arthritis and epididymitis. In a previous paper (9) we confirmed the work of Gross and Kall (10) who showed that novarsenobenzol injected intravenously sometimes had a curative action in pyelitis. In a series of 11 cases of staphylococcus pyelitis, which were mostly chronic cases and had resisted other forms of treatment, 7 became sterile after intravenous injections of novarsenobenzol. Similar success was obtained in 2 out of 3 cases of staphylococcus cystitis and prostatitis. In 6 cases of pyelitis in which the colon bacillus was present alone, only 1 became sterile. The urine after injections of novarsenobenzol shows definite bacteriostatic power against the staphylococcus, but none against the colon group. More recently we have employed novarsenobenzol intravenously

in cases of acute and chronic gonorrhea with such complications as epididymitis, prostato-vesiculitis, and arthritis. One case of gonorrheal arthritis, seminal vesiculitis and prostatitis, given one injection of 0.75 gram 2 injections of 0.9 gram of novarsenobenzol, was immediately improved and culture from the urine became sterile within ten days. Another case of chronic gonorrheal arthritis and seminal vesiculitis was also sterilized after one injection of 0.45 gram, 3 of 0.6 gram and 6 of 0.9 gram. Examination then showed that the patient was apparently entirely well. In other cases of chronic gonorrheal urethritis, prostatitis and vesiculitis, the patient was improved but the urethral discharge was still positive. In 1 case with very extensive swelling of the prostate and seminal vesicles with a gonococcus infection, a remarkably rapid disappearance of the infection occurred after intravenous use of novarsenobenzol. In other cases of vesiculitis, due to Gram-positive cocci, the use of novarsenobenzol was only occasionally successful.

It may be, therefore, stated that in novarsenobenzol we have a drug of definite value when used intravenously against both Gram-negative and Gram-positive infections, but in the latter it is apparently not so efficient as mercurochrome. The same precaution should be taken as in the treatment of syphilis with this drug. Arsenical dermatitis and other reactions have occurred in some of our cases. However, no permanent bad effects have resulted.

GENTIAN VIOLET

The remarkable germicidal action of this drug for Gram-positive staphylococcus was demonstrated by Churchman in our clinic in 1912 (11). Since then he has presented numerous other papers which have shown that this drug possesses great value in local infections. In a recent paper (12) in conjunction with our other studies of intravenous germicidal therapy we demonstrated that doses of 5 milligrams per kilogram of gentian violet could be tolerated without difficulty by animals and by human beings, and that the drug was eliminated through the urine in bac-

tericidal quantity. It was first employed, as an intravenous germicide, in the following case (12):

Ureteral calculus; Staphylococcus aureus urinary infection; intravenous injection of gentian violet; sterilization.

J. D. G., aged forty-seven years, admitted Brady Urological Institute June 29, 1923. Diagnosis of calculus of the left ureter just above bladder was made and ureteral dilatations and injections of oil, etc., were employed with the hope of causing the stone to pass. During this treatment patient developed an infection of left ureter and kidney with Staphylococcus aureus. Only July 12, 1923, he received gentian violet, 1 per cent solution, 50 cc. (7 mgm. per kilogram) intravenously. Except for slight uneasiness in the abdomen patient had no reaction. Pulse, temperature and respiration remained normal. No nausea, vomiting or diarrhea, but the skin became very blue. This subsided within six hours. Urine voided one hour after injection had a marked violet tinge. Colorimetric tests showed gentian violet present in a dilution of 1:50,000. Specimen one hour later contained drug in dilution of 1:100,000. A trace of the drug was present at the end of twenty-four hours. Cultures taken from the urine several days later showed a complete sterilization, no organisms being present.

Since this report we have used gentian violet in numerous cases in which a staphylococcus infection was present with some brilliant results and a good many failures. In 4 cases of urinary infection treated with gentian violet, the results obtained were as follows:

In a case of ureteral calculus with Staphylococcus aureus present, the urine was sterilized after one injection. In a case of cystitis prostatitis and urethritis with staphylococcus and streptococcus in the urine, the staphylococcus disappeared after one injection of 40 cc., 1 per cent solution, and the streptococcus persisted. A case of gangrenous tuberculous cystitis following operation, Gram-positive diplococcus present in the pus, showed marked improvement following one injection of 40 cc., 1 per cent solution. One case of nephritis following otitis media with lung abscess and streptococci in the urine immediately improved and ultimately recovered following four injections of 10 cc., of a 1 per cent solution.

Other cases in which the drug was not successful have been recorded. Our conclusions are that as a whole the drug is not so successful as mercurochrome, but when the latter fails it may be tried in doses up to 5 mgm. per kilogram of body weight. A 0.5 or even 0.25 per cent solution should be employed for intravenous injection. It is not followed by diarrhea or stomatitis but there is often a marked drop in the blood pressure and a sinking feeling which may require stimulation. The patient generally becomes blue in color. Large doses are to be avoided as transitory albuminuria and casts may be produced. Taken in conjunction with mercurochrome it is unquestionably a valuable addition to urological therapeutics.

CONCLUSIONS

As set forth in this article, sufficient experimental and clinical data have been furnished to prove, we believe, conclusively that in intravenous therapy with the drugs mentioned in this paper, very positive and valuable results have been obtained in the treatment of urological infections. Gentian violet and novarsenobenzol have been shown to be occasionally of very great value in coccus infections. Mercurochrome has been shown to be of great value not only in staphylococcus infections but in cases of streptococci and bacilli of various types. As a whole, the results obtained with mercurochrome have been distinctly superior in all types of infection to those obtained by novarsenobenzol and gentian violet. The three drugs, however, may be used seriatim or intermittently, according to the results obtained with one of these drugs previously used. In these drugs we have a therapy of great value in the sterilization of acute and chronic urinary infections. None of them are specific nor are they universally successful. There are many failures in which it is impossible to explain why no success has been obtained, whereas in exactly similar cases immediate results are obtained. However, admitting the failures and the reactions, which are often disagreeable and in a few cases painful, the sum total of results which have been obtained are indeed brilliant and we feel that a urological therapy of great importance has been opened.

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CLINICAL RESULTS WITH INTRAVENOUS CHEMOTHERAPY IN URINARY INFECTIONS

WILLIAM F. BRAASCH AND HERMON C. BUMPUS, JR.

Section on Urology, Mayo Clinic, Rochester, Minnesota

Recent literature has contained many reports of patients suffering from various forms of infections who have apparently been cured following the intravenous injection of different compounds, including mercurochrome, acriflavine, gentian violet, hexamethylenamin and urosol. Usually the results have been entirely empirical, and but few of them have been carefully controlled by laboratory data. In fact, a number of observers have endeavored to determine the therapeutic value following intravenous injections by experiments on animals, and the results have been variously explained as being due to a blood agglutinant, a destroyer of leukocytes, an anticoagulant, and an antiseptic. Many of these characteristics, however, have been denied as a result of subsequent investigation, particularly by Spencer, who asserts that with regard to acriflavin he has found that it has no agglutinating action nor does it have much effect on the number of erythrocytes, but does increase the number of leukocytes. Furthermore, he found that the intravenous injection of germicides does not lead to an increase in the bactericidal action of the serum when tested against *Staphylococcus aureus*. That the concentration of mercurochrome in the blood and tissues following intravenous injection is not sufficent to have any direct bactericidal action has been shown. Hench, Greene and Snell have found that it is more concentrated in the bile than in any other part of the body, and that even this concentration is not bactericidal, as shown by rapid growth of bacteria in the presence of such bile. That there must be some action other than antiseptic in the intravenous administration of drugs is also shown by the results obtained by mediums which were not bactericidal.

The compound known as Bayer 205 used in African sleeping sickness is not directly germicidal but enables the patient to develop an immunity to the germs of sleeping sickness. Luker, in the treatment of puerperal septicemia, found that the mortality was reduced from 32 to 5 per cent by the use of intravenous quinin. Robertson, in his article on the results of the intravenous use of urosol, flatly denies the possibility of antiseptic action on the part of this drug following intravenous injection. He maintains that its dilution would be so great that bactericidal action would be impossible. He says that the injection of the drug acts similarly to a protein injection, and that it has a secondary toxic effect on the bacteria. Wright has shown recently that it is not difficult to conceive that an effective bactericidal stimulus might be supplied by chemical agents other than bacterial antigens. Dale believes that the present status of chemotherapeutic study suggests the following possibilities of the action of the newer antiseptic remedies: (*a*) that they do not kill the parasites immediately, but modify their virulence or lower their resistance to the body's natural defenses; (*b*) that they form in the body some directly toxic product, either by modification of its structure or by its union with some tissue component, and (*c*) that they have an affinity for certain cells of the host's body, leading to the formation of a depot from which the curative substance is slowly relieved. In any event, it has become clear that narrow points of view no longer suffice to promote a scientific aspect of chemotherapy.

We are inclined to agree with recent observers that the results of intravenous injection of the various antiseptic solutions, such as mercurochrome, are not obtained by direct germicidal action, but rather that the process involved is more complex and probably of a biologic nature.

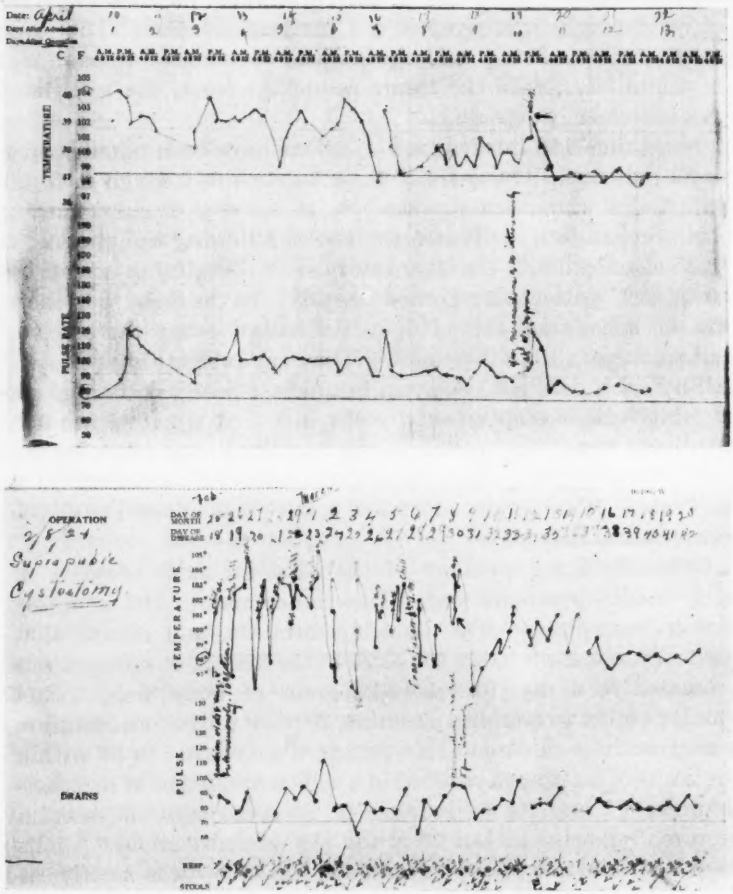
Mercurochrome was first used on the urologic service at the Mayo Clinic in March, 1924, in the treatment of a patient being prepared for prostatectomy. He had been losing ground for several weeks, as a result of acute pyelonephritis. All the usual remedies for the condition were employed without apparent benefit, including suprapubic drainage, blood transfusions, and

the intravenous administration of gentian violet. As the prognosis was apparently hopeless it was deemed imperative to adopt drastic measures and 5 mg. of mercurochrome for each kilogram of body weight was given in a 1 per cent solution. The fever subsided immediately and the patient commenced to improve. A month later, with the recurrence of the fever, the treatment was successfully repeated.

Since then 118 intravenous injections have been administered to 82 patients. Thirty-six of these treatments were given to 26 patients in whom acute pyelonephritis developed, either during their preparation for prostatectomy or following the operation. In 25 of the patients the fever returned immediately to normal by crisis; in 11 patients it returned by lysis. In the first group there was no subsequent rise in 9; in the second group there was a recurrence in all but 1 patient. This may indicate that when a fall by crisis does not occur, an insufficient dose has been given, a point further emphasized by the fact that when subsequent treatment was given because of the continued fever following the first administration, the temperature returned to normal in 4 of 8 cases. Usually an interval of a week was allowed to elapse between treatments.

Originally 5 mg. or more of the drug for each kilogram of body weight was employed. This caused nausea and vomiting almost immediately after its administration, and fearing that such a dose was probably too close to the margin of safety it was decreased to 4 mg. for each kilogram of body weight, and finally in order to establish a routine, 20 cc. of a 1 per cent solution was given in each case. This dosage was believed to be within the limits of safety and resulted in a sufficient number of reactions to make us hesitate to increase it, as some type of reaction occurred following all but 28 of the 118 administrations. Chills were the most common aftermath; diarrhea was nearly as common. Vomiting occurred often and was colored by the dye. Complications frequently occurred together. Usually after a lapse of twelve hours the reaction subsided completely. For a time we believed that subsequent treatments were not as likely to produce untoward symptoms as the initial administration of the

drug. Statistical investigation, however, showed the opposite to be true, namely, that reactions occur more times after repeated



TYPICAL TEMPERATURE CHARTS FOLLOWING INJECTION OF MERCUROCHROME

treatment than freedom from reaction. However, the reactions are seldom as severe and hence give the impression that those following the initial treatment are the only ones experienced.

Encouraged by the results in cases of acute pyelonephritis complicating prostatic obstruction, the drug was given 48 times to 35 patients with chronic or subacute pyelonephritis resulting from other causes. Half of these treatments were given during febrile periods, and in 50 per cent of patients the fevers returned to normal and remained so. In the other half of this group the mercurochrome was given during afebrile periods in the hope of reducing or eradicating the infection present. A check on the cell count in the urine before and after treatment failed to show any beneficial results. Only during acute exacerbations of the chronic infection could the drug be considered of benefit, and then in only half of the cases.

CYSTITIS

The same method of treatment was employed in 9 cases of cystitis including 3 of the type described by Hunner as elusive ulcer of the bladder. The results were most discouraging except in one of the latter in which an hourly day and night frequency of several years' duration was completely alleviated, and had remained cured when the patient was last heard from two months after treatment. One of the other 3 patients was also benefited although not so markedly.

PROSTATITIS

The drug was given 15 times to 9 patients with chronic prostatitis without any appreciable alteration in the disease. It was employed with similar results in a case of cystinuria, essential hematuria and tuberculous cystitis.

Of the 118 treatments with the drug, 69 were given during an elevation of temperature, and in 28 the temperature returned to normal and remained so, 20 times by crisis and 8 times by lysis. Besides the antipyretic action in acute cases no definite benefit could be demonstrated from the 49 treatments in afebrile cases.

INTRAVENOUS HEXAMETHYLENAMIN

We have used hexamethylenamin intravenously in 76 cases of acute and subacute urinary infections. Whenever a rise in tem-

perature is noted following any manipulation in the urinary tract, 5 cc. of a 10 per cent solution is given intravenously, being repeated daily if necessary for six days. Even though no attempt is made to acidify the urine it is remarkable how frequently the fever is controlled and symptoms alleviated. None of the gastric upsets associated with its oral administration was noted, and this much smaller dosage seems to produce effects equivalent to those formerly obtained by a much larger dose by mouth.

FISCHER'S SOLUTION

The treatment of acute urinary retention from prostatic obstruction associated with high blood urea values and the complete absence of phenolsulphonephthalein return, has been greatly enhanced by the gradual decompression of the bladder. We believe an equally important procedure in these cases is the early and repeated administration of Fischer's solution. The solution consisting of sodium chlorid and sodium carbonate apparently neutralizes the toxins present in the tissues of these patients and permits the kidneys to function normally under an active regimen of forced fluids. Urea values of more than 150 mg. for each 100 cc. of blood have frequently been reduced to within normal limits within a few days by the repeated intravenous administration of the drug. So striking and frequent is this result that 500 cc. of Fischer's solution is now administered as a routine in all cases requiring gradual decompression. Great care is necessary in the administration of the drug for it is very caustic to the tissues and even a few drops outside of the vein will invariably result in the most distressing sloughs. Like other intravenous drugs, care must be exercised to see that it is given entirely intravenously. It must also be given very slowly for if administered rapidly, the same caustic effect soon forms a thrombus in the vein before more than 150 or 200 cc. is given. Occasionally its administration is associated with the patient's rather alarming and sudden collapse, the pulse becoming feeble and the respiration slow and sighing. If given slowly these effects will be noted before they become alarming. In spite of these various drawbacks, however, we find the drug an indispensable aid in cases in which urea values are high.

PHYSIOLOGIC SODIUM CHLORID SOLUTION

We wish to call attention to the advantages of giving physiologic sodium chlorid solution intravenously, rather than subcutaneously. In urologic practice the subcutaneous administration of this solution, instead of being an emergency procedure, frequently is a daily necessity. The repeated introduction of so many large caliber needles, and so much fluid into the connective tissue of the chest, is an ordeal of which patients complain greatly. The soreness from one injection has hardly subsided before another is given on the opposite side. It is evident that the chief reason for the popularity of the method is the ease of administration. The nurse or interne thrusts the needle into the subpectoral tissues and the task is done. If the same amount of fluid is run slowly into a vein through a small caliber needle much time is consumed, and on a busy service this is important. Yet from the standpoint of the patient the latter procedure is far more desirable, the effects are more rapid, and of equal value. With care the same vein may be used repeatedly. In a recent case on our service 500 cc. of the solution was given into the same brachial vein on nine successive days, the patient pleasantly anticipating the hour consumed in the procedure when he was receiving active medical attention rather than dreading the four or five hours he would be left to the sole companionship of a subcutaneous apparatus.

CONCLUSIONS

Of the various mediums employed with intravenous chemotherapy, mercurochrome has probably proved to be the most efficient. It is particularly effective in cases of acute and subacute infections of the urinary tract and it has also been of great value in occasional cases of acute general sepsis of various types. In chronic infections involving the urinary tract and other tissues it is not of great therapeutic value. The greatest objection to its intravenous use is its toxicity. Severe reactions are common, marked by prostration, chills and dysentery. Two of the 196 patients who received intravenous injections of mercurochrome

at the Mayo Clinic during the past year died. Necropsy in one case demonstrated that in the absence of any other cause of death toxemia was the probable lethal factor. It is evident, therefore, that mercurochrome should be used intravenously only if emergency demands it. Although the element of danger is ever present, nevertheless, in cases of acute sepsis, when other measures have failed, it merits trial. The number of spectacular recoveries reported following its use excludes the possibility of coincidence.

Intravenous chemotherapy, while still in its infancy, promises well. Our present methods of applying the treatment are probably comparatively crude. Our progress in the past has been largely on an empirical basis. In order to make progress in the future it will first be necessary to study the exact changes which take place in the blood and tissues following the intravenous administration of the drug.

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BLOOD TRANSFUSIONS IN GENITO-URINARY SURGERY

MONTAGUE L. BOYD

Atlanta, Georgia

Received for publication June 15, 1925

My experience with transfusions of blood in 18 cases has proved so satisfactory that I am anxious to call the attention of the members of this Association to the possibility of its proving of equal value to them.

Transfusions of blood seem to me to be particularly helpful in genito-urinary surgery for, unfortunately, a large part of major urological operations are upon those who are not in the good physical condition in which we would like to have our patients for operation. Furthermore, prostatectomy, nephrectomy, nephrolithotomy, and at times pyelotomy, which are the operations commonly confronting the genito-urinary surgeon, are all rather difficult and more or less bloody operations, tending to produce more shock than many of the general surgical operations which are also of a serious nature. It seems to me, therefore, that the genito-urinary surgeon is particularly in need of the assistance which transfusions offer in overcoming shock and replacing lost blood. From my own experience I know that, by the use of transfusions, lives can be saved, postoperative complications prevented or their seriousness minimized, hemorrhage controlled or stopped, and convalescence shortened.

As I see it practically all of the arguments are in favor of the use of blood tranfusions, and very few against it. In only 1 of my 18 cases was any real difficulty experienced as the result of the transfusion. In this patient (case 16) each of 3 transfusions produced marked reactions. I have no explanations to offer con-

cerning this difficulty, for the donors were different each time and the blood seemed to have been matched satisfactorily. With the almost uniformly good results experienced with the other cases, however, the misfortunes I experienced with this one detract very little from my enthusiasm for the use of the procedure.

The principal trouble which I have encountered in transfusing patients was in finding a suitable donor in the emergency in which they were needed, and in having someone available who was skilled in the technique of transfusions. I am frank to confess, however, that in most instances these obstacles would not have arisen if, by exercising a little foresight, I had had my patient's blood typed and matched before operation and had made the other necessary arrangements for the transfusion in case it became necessary. I do that now before every major operation if there is any doubt about the outcome.

The chief difficulty about finding donors was in obtaining one whose blood would match that of the patients, and in several instances a large number of bloods have been examined before a suitable one was found, and in two instances (cases not included) I was never able to find a suitable donor. I have had no trouble in finding people who were willing to give their blood, for it is remarkable how willing they are to submit themselves to this procedure when they think they can help to save a life or do some real good. The patients, themselves, and their families have all been very willing to have the transfusions done, and I have been pleasantly surprised at the readiness of their support and co-operation.

The principal source from which most of the donors are obtained for my cases is a military station near Atlanta. The blood from a number of the soldiers, who are willing to act as donors, is already typed so that only those of the needed type are called upon when the occasion demands. They only receive a small fee for their services, and seem very willing and cheerful about the whole matter, even when their bloods do not match and they have made the trip to the Hospital for nothing, as it were.

At least 3 of my cases were saved from death by being transfused. One (case 1) a severe, acute, streptococci pyonephrosis fol-

lowing a herniotomy, where a nephrectomy seemed inadvisable and a nephrotomy was performed, and was followed by an extensive infection and necrosis of the wound and kidney. Another (case 2) was a man I operated upon for perinephritic abscess which had developed following a nephrolithotomy done a year before I saw him. The scar tissue formation about the kidney was extraordinary and the operation very serious. He, like case 1, had three transfusions and is well today, though I do not believe that it would have been possible for him to have recovered without them. The third case (case 3) was a patient who had had a nephrolithotomy on both sides, and subsequently both sides had abscessed, broken open and discharged continuously a purulent urine of unpleasant odor. The 'phthalein test, as well as could be determined, was, at most, only 4 or 5 per cent on either side when collected for twenty minutes after an intravenous injection. Naturally he did not feel well, but the thing that seemed to give him the most concern was having to wear the urine soaked dressings all of the time. Most of the drainage was from the right side and we tried all kinds of methods of draining the urine into a bottle through a tube, but were unsuccessful because of the discomfort caused by the tube pushing upon the stones, which were in the kidney pelvis, and only about three centimeters beneath the skin. A roentgenogram misled me to believe that they did not extend into the calyces but were lying entirely in the pelvis. I finally agreed to take the stones out, and began the operation under local anesthesia. I was soon convinced that I had undertaken more than I had intended, but since he was very insistent that he did not wish to go on wearing urine soaked dressings, I switched to gas-oxygen anesthesia and finally removed all of the stones which were found to branch out into many of the calyces. He bled rather freely, as he had done at each of his other operations, and was very sick afterwards. I am convinced that without the two transfusions, each of 500 cc. of blood, which he received, he would not have survived.

Two cases were greatly assisted in their recovery by transfusions, so much so that I am inclined to classify them with the three cases which were actually saved from dying by that method.

One was a man of seventy-eight with a hydronephrosis and chronic infection of the kidneys and bladder which resulted from prostatic hypertrophy and a vesical calculus. After a suprapubic cystotomy he developed an acute pyelonephritis and was critically ill for eight days—until two transfusions of 500 cc. of blood were given him. The other was a woman upon whom I performed a nephrolithotomy because she was having rather severe symptoms, the result of intermittent attacks of obstruction caused by a stone which was in the renal pelvis. She had had a left nephrectomy two months before, and a tonsillectomy fifteen days before the nephrolithotomy and was consequently not in very good condition. Her pulse was 160 and the respirations 32 at the end of the operation and she was very sick for some days. After a transfusion of 400 cc. of blood she was better and eventually on the forty-first day was discharged quite well.

It is interesting to note that 4 of the 5 cases just mentioned had an infection of the kidney or kidneys and 4 of them had renal calculi. In 2 cases there was a rather marked increase in the concentration of the urea and non-protein nitrogen in the blood—case 3: urea 52 mgm., non-protein nitrogen 107 mgm.; case 4: urea 34 mgm., non-protein nitrogen 45 mgm. Of course the kidneys were not directly benefited by the new blood, but the transfusions afforded the body much needed assistance in overcoming the infections and in that way lessened the load on the kidneys, and, by diluting the blood, reduced the concentration of the retained substances. The fact that they were benefited by the transfusions at least goes to prove that the concentration of these substances in the blood, which the kidneys are supposed to eliminate, is not a contraindication to transfusion.

I found transfusion advisable in two cases as a preparation for operation. One a case of papillary carcinoma of the kidney where a long continued hematuria had produced a severe anemia, and the other a case of chronic obstruction to the outflow of urine from the right kidney which had resulted in a very large hydronephrosis; he was much emaciated and anemic and could not have stood the nephrectomy without the assistance of the transfusion. In both cases a nephrectomy was successfully performed,

and the value of the transfusions proven to my satisfaction, though subsequently one died of carcinomatosis and the other of a cerebral embolus which came from an infected endocarditis.

In six instances (5 cases) I employed transfusions to stop pre- and postoperative hemorrhage with satisfying success. In case 8, a man seventy-eight years old had a severe bleeding into the bladder from the surface of a fairly large intravesical prostatic protrusion for three and one-half days. He showed plainly by both his appearance and by his pulse the damaging effects of the hemorrhage. A transfusion almost immediately stopped the bleeding, greatly improved the pulse, and relieved the restlessness which he was beginning to experience. In the same case, and in cases 9 and 10, I had a troublesome bleeding following prostatectomy in spite of the employment of the Pilcher bag. All of them stopped bleeding almost completely immediately after the transfusion. In one of them (case 9) the bleeding began again in forty-eight hours, but was permanently controlled by a second transfusion. Another patient (case 11), to whose case I referred in a paper on prostatectomy before the Southern Medical Association two years ago, had a severe hemorrhage from a prostatectomy wound eight days after the operation, which was caused by overdistending the bladder due to cutting off the drainage through his suprapubic drainage tube. Through the employment of a Hagner bag and a blood transfusion the bleeding was stopped, and it is very likely that the transfusion not only assisted in stopping the bleeding but saved his life by partially replacing the lost blood. In case 12, the patient began bleeding severely ten days after a punch operation with the Caulk cautery punch. The bleeding was so severe that I opened the bladder suprapubically and packed the posterior urethra with gauze and left in a suprapubic drainage tube. Immediately afterwards he was given a transfusion of 500 cc. of blood and though the packing was removed about an hour later he had no further bleeding except a slight oozing and he felt a great deal better as soon as the blood he had lost was partially replaced by the transfusion.

One patient (case 13) came into the hospital bleeding severely from the surface of the middle lobe of a much enlarged prostate.

He had had a suprapubic cystotomy performed at another hospital two weeks before, and had been bleeding twenty-four hours before I saw him. Ordinary measures did not serve to stop the bleeding, and, as no donor could be found for immediate use, a prostatectomy was performed and a Pilcher bag left in the wound for an hour and a half. He was transfused the next day and in spite of having lost a great deal of blood he had a very good and uneventful convalescence, due, in a large measure, I think, to the transfusion.

In 1922 a very anemic man came to see me (case 14) who had had hematuria for two years. I located the bleeding area in the prostatic urethra, just this side of the vesical orifice, and tried all of the usual hemostatic measure without avail. By a rather extensive, superficial fulguration of the bleeding areas I stopped the hemorrhage for a day or two, but it was soon as bad as before. Eventually I fulgurated the urethra again and immediately afterwards gave him a transfusion of 500 cc. of blood, with the result that the bleeding was permanently stopped and the symptoms arising from the anemia considerably relieved.

The 4 cases in which transfusions were given without avail include one (case 15) hopeless case of carcinomatosis in which I unsuccessfully attempted by transfusion to stop the bleeding from the growth in his bladder. Two others were prostatectomy cases; one (case 16) had a light up of a pulmonary tuberculosis thought to be inactive, and developed a reaction three separate times after receiving small amounts of blood and died; the other (case 17) received two transfusions of 500 cc. of blood each, was improved each time, but grew steadily weaker and died in spite of the transfusions, a good kidney function, and what appeared to be a normal cardiac action. He bled a fairly good deal at operation and afterwards, but not sufficiently to make me consider the hemorrhage serious. He was morose, and made no effort whatever to get well; a mental condition probably resulting from a long standing chronic urinary infection and probably a sclerosis of the arteries of the central nervous system. The other (case 18) was a patient with a renal hematuria, the origin of which was never satisfactorily explained, although a nephrectomy was

eventually performed and the kidney carefully examined. He was transfused for the purpose of stopping the bleeding, which was, however, only arrested for a day or two.

CASE REPORTS

Case 1. F. M. W. December 5, 1922. Aged twenty-two, single, medical student. Grady Hospital No. 15377. Admitted to the surgical service for an operation for the cure of a right inguinal hernia.

Family history and past history. Unimportant.

Present illness. Twelve years ago he was thrown from a bicycle. The handle bars struck him in the groin and subsequently he developed an inguinal hernia where he was struck.

Physical examination. Negative, except for a few hyaline casts in the urine.

Herniotomy under ether anesthesia. December 6, 1922. The wound healed per primum and gave no trouble at all.

After the operation he had to be catheterized for several days. There was very little fever until the fourth day when his temperature rose to 102.2. Again there was very little fever until the thirteenth day when his temperature began to show evidences of an active infection. The urine was cloudy and contained pus and a good many chains of gram positive cocci.

On the sixteenth day I catheterized his ureters and found the left kidney seemingly normal. The urine from the right kidney contained streptococci and a good deal of pus, and there was only 3 or 4 per cent of 'phthalein put out in twenty minutes after an intravenous injection, with about 15 per cent in twenty minutes on the left. The time of appearance of the dye was five minutes on the left and twelve minutes on the right. The right kidney was considerably enlarged, and a blood count showed 43,000 white cells with 98 per cent polymorphonuclears.

On the seventeenth day (December 23, 1922) I performed a nephrotomy, under gas-oxygen anesthesia. There was a great deal of edema of the perirenal tissues; the kidney was much enlarged and contained many small abscesses. It was decapsulated and several openings were made through the convex surface into the pelvis in which rubber tubes were placed and left for drainage. The wound was closed hurriedly with stay sutures, several large tubes being placed about the kidney for drainage. The pulse rate at the end of the operation was 112, and the volume poor.

Abdominal distention, vomiting and pain followed the operation. The temperature subsided very little, remaining at 102 and 103 a good deal of the time. Eventually the whole wound became infected and had to be opened, and there was a good deal of sloughing of the tissues of the wound and of the kidney.

On the thirteenth day the red blood cells were 3,390,000, and the hemoglobin 39 per cent. He was transfused, being given 500 cc. of blood by the Linderman direct method. He then began eating and sleeping some better, and on the sixteenth day the blood showed 48 per cent hemoglobin, blood urea 13 mgm., non-protein nitrogen 48 mgm., and creatinine 1.76. The fever still remained pretty high.

On the seventeenth day he was given another transfusion of 300 cc. of blood, after which the temperature began to drop lower for part of the day. He was having, however, a good deal of pain in the back, legs, and over the bladder, and there was a severe burning on urination. At one time there was tenderness to pressure over the left kidney, both in front and behind, but I do not believe that the left kidney was ever infected. He was very weak and suffered a great deal.

It was not until the fifty-ninth day that the temperature became normal. The temperature had gradually grown less, however, and the wound had been healing and looking better. On the fifty-seventh day he was given another transfusion of 500 cc. of blood, which seemed to improve him a great deal and on the following day the blood showed—red blood cells 4,200,000, hemoglobin 50 per cent, white blood cells 11,000.

He was discharged on the eighty-ninth day with 4,690,000 red blood cells and 55 per cent hemoglobin. The 'phthalein test showed 22 per cent the first hour, and 15 per cent the second.

I last saw the patient October 25, 1924. He had been well and strong for a long time. The 'phthalein test was 41 per cent the first hour and 12 per cent the second. The urine showed no signs of infection nor inflammation. He would not submit to a ureteral catheterization, which I wished to do so that I might learn how much the right kidney had been destroyed.

I fully believe that without the blood transfusions that this patient would not have had the strength to overcome the severe infection, which not only pervaded the renal and perirenal tissues, but involved the whole nephrotomy wound as well.

Case 2. P. F. R. July 18, 1922. Aged twenty-eight, married, travelling salesman. Piedmont Hospital No. 1636.

Complaint. General malaise, a slight rise in temperature in the afternoon, and a cloudy urine.

Family history and past history. Negative, except for a pneumonia eight years before I saw him, which was without complications, "flu" in 1918 and a maxillary sinusitis in 1914. He had had no genito-urinary troubles.

Present illness. In 1918 dull, aching pains began in the right back over the kidney, which very gradually grew worse. There was no disturbance of urination, and no blood nor pus in the urine. A routine examination made in a free clinic in 1920 showed stones in the right kidney, and he was operated upon April 6, 1921, and stones removed from the lower and middle calyces. He was quite sick after the operation and the wound was unclosed for more than six weeks.

He was never well after the operation, and he has had more or less constant irritation in the bladder with burning on and an increased frequency of urination. The urine has remained more or less constantly cloudy, and there has been a dull aching pain over the right kidney behind. For several months before he saw me he had an occasional sharp pain in the right hypogastric region.

Examination. My examination showed the patient to be normal except for those things which had to do with the right kidney. He was pale, nervous and irritable. There was a scar of a kidney incision in the right side, with tenderness on pressure over the kidney behind and in front, but there was no muscular rigidity. A definitely outlined mass was felt in the kidney region, which descended a little on deep inspiration. The left kidney seemed to be normal to palpation. Ureteral catheterization disclosed a much impaired right kidney. The 'phthalein test (6 mgm. intravenously) showed, through a catheter in the right ureter, an appearance time of ten minutes, with an output of 3 per cent in twenty minutes; on the left an output of 20 per cent in twenty minutes. The urine from the right kidney contained a moderate number of pus cells, a few bacilli, morphologically like colon, and a few chains of streptococci.

Later, on July 21, some unexplained obstruction was found in the left ureter—A No. 5 F. catheter would not pass more than 10 cm. The urine was uninfected and seemingly normal. A month later, a pyelo-ureterogram was done. The pelvic capacity (with normal saline

solution) of the left kidney was about 7 cc. and that amount of sodium bromide was injected with the tip of the catheter in the upper ureter. The roentgenograms showed a practically normally distended pelvis and calyces, with a continuous filling of the ureter to about 2 to 3 cm. above the bladder, but no sodium bromide in the bladder. No enlargement of the ureter was noted, but at the tip of the catheter, 12 to 15 cm. up the ureter, there was a kinking of the ureter as though it were pushed up by the catheter.

Dilation of the left ureter was then undertaken, starting with a small size catheter and eventually employing a 9 F. Garceau catheter. This was kept up for about six weeks, when the ureter seemed to be satisfactorily dilated. On January 11, 1923, I operated upon him, with the idea in mind of removing the right kidney, if it were possible, since it was infected and its function badly impaired, and, if that were not possible, to open and drain whatever areas of infection existed in or about the kidney.

An incision was made along the line of the scar of the old incision. The scar was attached by dense adhesions to the tissues beneath, which, in turn, were very adherent to the kidney. The kidney was found to be high up under the ribs, and lying almost transversely across the back, with the upper pole almost over the vena cava and the aorta. The whole mass was so firmly fixed to the psoas muscle behind and to the ribs in front that it was impossible to separate it without cutting with the scissors or the scalpel.

On account of this fixation, I attempted to approach the pedicle from the front by pushing back the peritoneum. This proved to be impossible and a tear was made into the peritoneum, the edges of which were immediately closed with plain catgut. Since I was unable to reach the kidney pedicle from either the back or the front, an incision was made through the scar tissue about the the lower pole of the kidney. This was found to be almost like cartilage and 1 to 1.5 cm. thick. By enlarging this opening in the scar tissue, I was, with great difficulty, able to free most of the kidney. It was possible to free the upper and lower poles, but where it lay on the psoas muscle, the adhesions were so dense that it was impossible to get through them except by cutting. About the middle of the kidney on the ventral surface, I opened an abscess containing 60 to 90 cc. of pus, the only pocket of pus that I was able to find.

I was proceeding as rapidly as possible with freeing the kidney when the anesthetist announced that the patient's condition was so bad that

it was inadvisable to continue the operation. The wound was closed with haste by employing through and through silver wire sutures, several large rubber tubes being employed for drainage. On leaving the operating room, the patient's pulse was about 100 and extremely feeble. During the operation the pulse rate rose to about 140 and then dropped down to 120, where it stayed until the operation was completed.

After the operation the patient was very sick indeed, and we were at times very much discouraged. He vomited frequently for several days and there was a great deal of abdominal distention, which was not relieved by any of the usual measures. The temperature rose steadily throughout the second day until it reached 101. On the third and fourth days, it stayed up to about 100.5, though the pulse rate dropped at twelve o'clock on the third day from 115 to 80, where it stayed most of the time until the sixth day. This change in pulse was probably due to digifolin.

On January 15 (the fifth day), the patient was transfused, being given 500 cc. of blood by the sodium citrate method. On being returned to his bed, he stopped breathing for several minutes and artificial respiration had to be employed. There was no explanation for this, because he stood the transfusion very well. Following the transfusion the vomiting stopped for a while and he became almost free from nausea. The temperature dropped to normal the next morning and rose only a little over 99 in the afternoon. He was able to eat some food and retain it and the abdominal distention ceased to be annoying, though there was still some fullness remaining.

On January 17, the distention grew worse; about 6:00 p.m., it was very annoying. The pulse rate had risen to 105 and the nausea and vomiting, which had been improved by the transfusion, were growing worse again, and the vomitus was dark and had a fecal odor. Immediately after the operation, the patient's color had been very bad; his lips were almost white. The first transfusion improved this somewhat; but he now looked very pale again. A second transfusion was done on January 18. Five hundred cubic centimeters of blood from the same donor was given by the sodium citrate method. There was again a great improvement; the lips became pink, the pulse rate dropped from 100 to 80 and he only vomited two or three times a day for a couple of days, and then no more.

Although there was a wonderful improvement following the second transfusion and most of the annoying symptoms from which he had

suffered disappeared, the hiccoughing, which had occurred at intervals after the operation, grew annoying for the first time on the next day (January 19). On the 20th, they became more or less continuous, with only slight periods of relief. This lasted through the 21st, with occasional spitting up of some sour food, but almost disappeared by the 23rd.

He sat up in a chair on January 28 and began walking a little on February 4. He was discharged from the hospital on February 7, 1923, twenty-seven days after the operation. There was no longer any infection of the urine and only an occasional pus cell was to be found in it. I decided to keep the wound draining as long as there was the least need for it, so a tube was kept in it continuously until July 16, about seven months. In April, he was given a course of x-ray treatments, with the hope that it would assist in the absorption of the scar tissue. In May, the kidney could be distinctly felt, it was a little larger than normal, but descended very well on inspiration.

There was very little drainage from the tube after May, but about July 1, on passing a probe in various directions, I was able to determine that there was a fairly good-sized pocket up under the ribs. After attempting to sterilize it by injecting 2 per cent mercurochrome every day or two, for a week or ten days, I filled the pocket with Beck's bismuth paste. From this on, there was never any trouble. The sinus remained closed completely.

An examination made on January 25, 1924, showed that the patient was entirely well. The abdomen was soft and most of the scar tissue about the right kidney had disappeared. The kidney moved normally and did not seem to be enlarged. There was an occasional dull ache over the right kidney behind, which I think was natural, considering all the scar tissue which he had had there. I have seen him several times since then, and he has remained well.

While the amount of blood lost by this patient at operation was more than I liked, it was not sufficient to endanger his life. The shock which resulted from having to dissect the kidney out of the dense scar tissue seemed to me to be the thing that produced the most serious symptoms, and it was from the effect of this that he was saved by the transfusions, which I feel sure kept him from dying.

Case 3. M. H. Mc. August 1, 1924. Aged forty, married, druggist. Piedmont Hospital No. 5660.

Family history and past history. Unimportant.

Present illness. When ten years old he began having attacks of "renal colic" about every six months. He does not remember in which side they were, nor much about the details of the attacks. There was no blood in the urine accompanying them and no urinary symptoms, but the urine was cloudy at times. The attacks stopped when he was about fourteen and did not recur until about ten years later.

When he was about twenty-five he had a sudden attack of renal colic on the left side, with nausea and vomiting. For two years he was all right, but then he began having similar attacks of renal colic in the left side about every two weeks. At about thirty an x-ray examination showed stones in the left kidney (the right kidney was not examined) and a nephrolithotomy was done. Six months to a year later he began having attacks of renal colic in the right side which continued to occur at fairly frequent intervals until he was operated upon two years later and stones removed from the right kidney.

After that the urine remained cloudy and he knew that he was not well, but he had no especial trouble until December, 1923 (aged thirty-nine), when an abscess formed in the scar of the left nephrolithotomy wound. In about a week it broke open and discharged pus and urine.

I first saw him December 29, 1923. He had a sinus over the left kidney behind, which was discharging purulent urine of a bad color. The voided urine was quite cloudy, alkaline, and contained many bacilli like colon bacilli and some chains of cocci. 'Phthalein test (intravenous) showed only 3 to 4 per cent of dye coming from the right kidney and only a trace from the left (ureteral catheterization). The urine from both kidneys contained a number of colon-shaped bacilli and some chains of cocci. There were irregular shaped, large stones in both kidneys.

Radical measures for relieving him seemed to be inadvisable, so various palliative procedures were tried, among them the intravenous injections of a 1 per cent solution of neutral acriflavine. As was to be expected, nothing I tried did much good. In June, 1924, an abscess formed in the scar of the nephrolithotomy wound on the right side and I opened it under local anesthesia. A 'phthalein test, before the abscess was opened (intramuscular) showed a 10 per cent output through the bladder in an hour and fifteen minutes; nearly all of the urine was then coming through the bladder.

In July, 1924, he decided that anything was preferable to wearing the urine-soaked dressings over the kidneys, and I agreed to try to remove the stones from the right kidney which were preventing him from wearing

a tube. Most of the urine which drained out was coming from the right kidney and we thought that it might be possible for him to wear a Watson apparatus for permanent kidney drainage. A probe showed that the stones were about three centimeters beneath the skin, and in the roentgenogram the shadow looked as though the stones could be removed without great difficulty.

August 2, 1924, I tried to remove the stones under local anesthesia, but found that they had numerous branches extending into the calyces, and I had to employ gas-oxygen anesthesia to proceed with the operation. I was able to clean out the stones pretty thoroughly but not without the loss of a good deal of blood.

On return to his bed, his pulse was 112, and quite weak. He was very pale and his lips almost bloodless. A transfusion of blood (500 cc.) was given him by the Unger method by Dr. H. C. Sauls, and his lips became pink and his color much improved, the nausea was less, and the temperature and pulse rate began steadily dropping, though he continued to have a little fever all the time he was in the hospital.

On the tenth day the blood was—red blood cells, 3,420,000, hemoglobin 70 per cent, non-protein nitrogen 101.7 mgm., urea 52.5 mgm., sugar 166.6 mgm., creatinine 9 mgm.

He was very weak when he left the hospital on the twenty-fourth day but still improving.

On October 31, 1924, the patient seemed to be doing very well. He had been wearing a Watson apparatus for permanent kidney drainage and was far more comfortable than he had been for a long time. His general health had improved and he was much more hopeful. The blood showed—non-protein nitrogen 112.5 mgm., urea 48 mgm., sugar 156 mgm., and creatinine 2.2 mgm.

Each of the transfusions in this patient produced a very evident improvement, and he and I are both of the opinion that he could not have survived without them.

Case 4. B. W. September 3, 1924. Aged seventy-eight, married, farmer. Piedmont Hospital No. 5943.

Complaint. Painful and frequent urination.

Family history. Unimportant, except that an aunt died of cancer.

Past history. No illness of importance. "Epithelioma" of the nose twenty-five years ago, and a new growth on the forehead about two years ago. They were cured by local applications and internal medication. He has had some constipation for a good many years.

He has been getting up at night to void once or twice for several years, but has noticed no other urinary symptoms. During the past year or two he has had several attacks of fever, often with a chill, and often with an increased frequency of urination, and with one or two of these attacks he was pretty sick. The attacks lasted four or five days; there was no nausea and vomiting.

Present illness. Three months ago he began voiding more frequently than before, and passing only small amounts of concentrated urine (this was during a very hot summer). There was some pain in the neck of the bladder after urination, which often continued for five minutes; no blood. This increased frequency of urination became quite annoying, having gradually increased; he was voiding about every two hours or oftener at night. There were remissions in the severity at times, but at other times he voided as often as every twenty to thirty minutes. He has been confined to the bed very little of the time.

Examination. Mentally alert when conversing, but rather sluggish at other times. The pupils react rather sluggishly to light and accommodation. Knee kicks normal. Pulse 80 to the minute. Some emphysema. The septum of the nose was visible through an opening which extended from the bony bridge almost to the tip and opened into both nostrils. The process which had produced the opening had long been healed and left only a little scar tissue.

Blood: red cells 3,700,000, hemoglobin 75 per cent, white blood cells, 5600. Non-protein nitrogen 45 mgm., urea 34 mgm. creatinine 1.9, sugar 1.7. (The blood was taken shortly after breakfast.) Wassermann, negative. Blood typed for transfusion, type no. 1.

Rectal examination. There was a moderate bulging rectalwards of the prostate suggesting benign prostatic hypertrophy.

'Phthalein test (intramuscular): Appearance time twelve minutes; output in one hour and ten minutes through a catheter, 29 per cent.

Cystoscopic examination. A 26 F. cystoscope passed without difficulty, the tip encountering a stone. The bladder was washed clean with difficulty; it was markedly trabeculated, some of the depressions almost like beginning diverticula. Above the cystoscope a stone several centimeters in diameter was seen, the surface rough and brownish. The cystoscope could not be made to pass above it. There was a considerable swelling and reddening of the mucosa about the trigone and vesical orifice, obscuring the ureteral orifices and any tumor, if one existed. There was a moderate protrusion of the mid part of the prostate below, and a slight cleft above, suggesting an intravesical protrusion of an enlarged prostate.

Roentgenogram. There is a shadow of a stone about 5 cm. in diameter lying in the bladder region; fairly regular in outline.

Cystogram. About 200 cc. of a 10 per cent solution of sodium iodide were injected into the bladder through a catheter with the patient lying flat. There was no feeling of fullness of the bladder, but the roentgenograms showed the bladder fairly well filled, and there was a filling of both ureters and a distinct filling of the right pelvis and calyces and an indistinct filling of those on the left. Both ureters were slightly dilated.

The temperature was 99 on the afternoon of the day of admission, and the same the next day. In the afternoon of August 5, after the cystogram, it was 101.4 at 8:00 p.m., and the next day 102. From then until the day of operation (August 10) not over 99.

Because of the regurgitation of the vesical contents into the kidneys, the troubles in urination, and the blood retention, it was decided that the bladder drainage through a suprapubic incision was indicated.

Suprapubic cystotomy. September 10, 1924. Gas-oxygen anesthesia. A rough, irregularly shaped stone was found lying in the bladder, attached in some way to the bladder wall, exactly how I did not think it advisable to stop to investigate. The wound was swabbed with 2 per cent mercurochrome before opening the bladder and before closing the incision. The patient stood the operation well and was returned to his room with a pulse of 72, and respiration 16. A hypodermoclysis of 500 cc. of normal saline was given and digifolin, which was begun before the operation, was continued.

The next day there was some hiccoughing, and the temperature was up to 103 and stayed above 102 until 8:00 p.m. On the third day the temperature was 101 in the afternoon. He was not taking fluids well by mouth, and seemed a little irrational at times.

On the fourth day a blood transfusion was given—500 cc. of blood by the Unger method. The temperature was 99 and 99.5 until the seventh day. The wound became somewhat infected in the lower part and was opened pretty freely. There was hiccoughing and some nausea, and at nights he was irrational. On several occasions he was given 200 to 300 cc. of normal saline intravenously.

On the sixth day, after an intravenous injection of normal saline, he had a chill followed by an elevation of temperature to 104. The next (the seventh) day the blood showed red cells 3,460,000, hemoglobin 83 per cent, white cells 12,000 (polymorphonuclears 82 per cent). At 2:00 p.m. he was given 42 cc. of a 0.5 per cent solution of gentian violet

intravenously, and at 6:00 p.m. a transfusion of 500 cc. of blood by the Unger method.

At 8:00 a.m. on the seventh day the temperature was 101 and stayed about that high all day. After the transfusion at 7:00 p.m. there was a chill (which, of course may have been due to the gentian violet) and a rise in temperature to 103 at 8:00 p.m. and 104 at 10:00 p.m. At 6:00 a.m. on the eighth day it was 98.3.

The day after the transfusion it was 98.6 or 99 all day, but on the next day or two it went to 101 and 100. After the eleventh day it remained normal or subnormal during his stay in the hospital.

After the second transfusion he was distinctly better—he was no longer irrational, and the hiccoughing gradually disappeared. He grew steadily stronger and the wound healed very well.

He was discharged on the thirty-third day (October 12, 1924), wearing a suprapubic drainage tube which is to be left in indefinitely. March 11, 1925: The suprapubic drainage tube has been working satisfactorily. He has been walking about and is fairly well, though not strong. Cystoscopy shows a very great improvement in the condition of the bladder. 'Phthalein test shows 51 per cent output in two hours after an intramuscular injection.

Case 5. Mrs. B. S. June 1, 1924. Aged twenty-four, married, housewife. Grady Hospital No. 22880.

Complaint. Painful urination, bloody urine, enlarged tonsils.

Martial. Married two years and six months. One child eighteen months old, living and well. One child died at two weeks old.

Past history. Unimportant.

Present illness. Ten months ago she began to have painful and frequent urination. This was during a pregnancy, which went to term, however, but the child died two weeks after birth. She has been in bed most of the time since the beginning of the present illness, with pain in the lumbar region and painful and frequent urination. There has been blood in the urine for several weeks, but no clots. During the past month or two she has been better but she still voids very frequently—nine or ten times at night.

Physical examination. Negative, except that she was quite fat, and the abdomen somewhat pendulous. The tonsils were enlarged and somewhat congested. The right kidney was in normal position, and not enlarged. The left kidney was felt to extend down to the crest of the ileum and to be greatly enlarged, and somewhat tender. The

bladder urine was cloudy and contained many pus cells and many bacilli morphologically like colon bacillus.

Catheterization of the left ureter showed pus and colon bacilli in the urine from that side, and there was no 'phthalein in the urine in fifteen minutes after an intravenous injection. The dye appeared from the right side in five minutes and there was a 12 per cent output in fifteen minutes.

Pyelogram. June 11, 1924 An opaque catheter in the right ureter reached the middle of the sacroiliac joint. The filling showed a dilated ureter above that point. The left kidney was much prolapsed, lobulated, and enlarged with a dilatation of the pelvis and calyces. The lower pole was about 5 cm. below the crest of the ileum, the upper pole opposite the third lumbar vertebra. In the lower part of the kidney the shadow of a small stone was seen. In the right there was a shadow of a stone about 2 cm. in diameter, lying at the lower border of the twelfth rib.

Blood: Red cells 4,960,000, coagulation time two minutes and fifteen seconds. Blood urea 9.36 mgm. Wassermann, negative.

Cultures of the urine showed a Gram-negative, gas-producing bacillus from both kidneys. The total 'phthalein test (6 mgm. intramuscularly) 40 per cent the first hour, 5 per cent the second.

Operation. June 19, 1924. Left nephrectomy by Dr. Earl Floyd. The kidney was found to be greatly enlarged, rather thin walled, filled with purulent urine and containing several small calculi in the lower part. The calcyes were dilated into rounded sacs, two large ones occupying the lower part of the kidney. Recovery was uneventful. The urine from the right kidney remained infected.

Tonsillectomy. August 1, 1924. Recovery uneventful. Another examination showed the heart and lungs to be normal. 'Phthalein test: 35 per cent the first hour, 15 per cent the second. Before and after the tonsillectomy there were attacks of pain in the right kidney which were rather severe at times, and there was some blood in the urine with each attack.

Nephrolithotomy. August 16, 1924. Gas-oxygen anesthesia. The kidney was somewhat adherent, fixed rather high, and with a quite short pedicle. Because of these things and the fact that she was quite fat an attempt to remove the stone by a pyelotomy failed. It was even difficult to get the lower pole of the kidney in proper position for a nephrotomy with silver wire. Consequently there was a good deal of bleeding which was not well controlled until the sutures were placed

through the kidney substance. A small rubber tube was left in the pelvis of the kidney, and another large one in the wound extending to the lower pole. Before the operation the pulse was 80, respiration 18, and temperature 97. Afterwards the pulse was 160, respiration 32. About 400 cc. of normal saline solution were given intravenously before she left the operating room, and the pulse was much improved.

The next day (second) the patient was quite sick. The pulse was rapid and weak, and there was some nausea and vomiting. On that account, and because she had only one kidney which was infected, and now contained sutures she was given a transfusion of 400 cc. of blood by the direct method. The pulse dropped from 140 to 120, and stayed at 120–128 until 8:00 p.m. when it rose to 140 and the temperature to 102.2.

The third day the pulse was 110, temperature 99.2. Blood urea 6.6, red blood cells 3,500,000; white blood cells 19,000 (polymorphonuclears 88 per cent).

Until the ninth day the temperature was fairly high—100 to 102.4; only dropping to 99 and a little over. On the ninth day 98.4 was reached and after that 100 to 100.2 in the afternoon and about normal in the mornings. After the seventeenth day it was normal. She was out of bed on the twenty-sixth day, and was discharged on the forty-first day seemingly well.

On the eighth day the urine was practically free from pus, and no organisms were found. The blood urea was 5.6 mgm.

I believe that the blood transfusion was the means of saving this patient a stormy convalescence. It was bad enough as it was, for she was weak and had a good deal of gastro-intestinal disturbance. It seemed necessary to perform the last operation as soon as possible, because of the severe attacks of pain she was having as a result of the renal stone. I recognized the fact that it would have been better had it been possible to wait, for her to recover more fully from the nephrectomy and tonsillectomy.

Case 6. R. L. P. November 11, 1921. Aged fifty-one, married, butcher. Grady Hospital No. 10468.

Complaint. Blood in urine.

Family history. Negative, except that his mother died of cancer of the stomach.

Past history. Malarial fever in 1912. Typhoid in 1914, when he was in bed seven weeks and had some difficulty in holding his urine. Normal weight 130 pounds, and he has lost only 2 pounds.

Present illness. In 1918 he had an attack of pain in the back in the region of the left kidney, which radiated around to the left groin; dull, aching in character at first, later acute and shooting. He was somewhat relieved by morphine. After about two hours he voided and thinks that he passed a stone though he was unable to find one in the urine. He had blood in the urine for two weeks after the attack, and six months later he again passed blood in the urine and had a little pain behind over the left kidney. Since then the attacks have become more frequent, especially during the last six months, and he has passed a good deal of blood, but no clots.

Examination. A rather small, thin man, quite anemic looking. The left kidney is considerably enlarged, smooth, somewhat compressible, and only a little tender. Otherwise the examination is negative.

The bladder urine is quite bloody, but uninfected. With a cystoscope blood was seen coming from the left ureter. The urine from the right ureter was clear. Blood: Red cells 3,600,000, hemoglobin 40 per cent, white cells 4,200 (polymorphonuclears 60 per cent, small mononuclear 11 per cent, eosinophiles 6 per cent, transitional 2 per cent). An x-ray examination showed the shadow of a much enlarged left kidney.

Ureteral catheterization. The urine from the right side was normal. A small amount of bloody urine came from the left catheter when pressure was made upon the left kidney; no infection, very little pus. 'Phthalein test (intramuscular) 25 per cent the first hour, 20 per cent the second.

Pyelogram. The catheter would only pass 20 cm. up the left ureter. The roentgenograms showed the left ureter injected with the sodium bromide and a good deal of the solution in the bladder where it has passed back along the catheter. There was no filling of the kidney pelvis. The lower pole of the kidney seemed to overlie the crest of the ileum. A complete x-ray examination showed no evidence of metastases.

A diagnosis of malignant tumor of the left kidney was made and the patient was advised that transfusions of blood were necessary as a preparation for operation.

December 18, 1921. Blood: Red cells 2,800,000, hemoglobin 35 per cent. About 250 cc. of blood were given by the Linderman direct method of transfusion.

January 9, 1922. Red blood cells 1,580,000, hemoglobin 25 per cent.

January 13, 1922. Blood transfusion by the Linderman direct method; 480 cc.

Again on January 28, 500 cc. of blood were given him, and the red cells were then 2,500,000, and the hemoglobin 46 per cent.

Nephrectomy. Left (February 4, 1922): Gas-oxygen anesthesia. Through a loin incision a kidney about 25 cm. (10 inches) long was exposed. The pelvis protruded markedly, and was tightly distended. There were only a few perirenal adhesions and the kidney was freed and punctured, releasing a large quantity of bloody fluid. It was then seen that the tumor consisted of a thin walled sac of a kidney, distended with a dark bloody urine. It and the upper ureter were removed. The patient stood the operation very well.

Pathological description. The specimen consists of a greatly enlarged left kidney. The calyces have been obliterated and the thickest part of the kidney substance is only about 0.5 cm. in thickness. The surface is smooth, but lobulated. The pelvis protrudes about 5 to 8 cm. (2 to 3 inches). When opened the inner surface is seen to be somewhat rough with a granular appearance, but without any distinct papillae. The lower part of the pelvis and the upper ureter are a good deal thickened, and quite firm, the passageway from the pelvis into the ureter being almost completely blocked.

The specimen was lost between the operating room and the laboratory, but subsequently papillomata appeared in the bladder, and, at a ureterectomy, were found in the ureter. A diagnosis of papillary carcinoma of the kidney and ureter were made. The patient subsequently died of carcinomatosis, the most annoying metastasis being in the left ileum.

When he first entered the hospital he was in very poor condition on account of the bleeding. By transfusions he was wonderfully improved and stood the operation well, and went back to work, from which he was stopped by bleeding from the bladder due to several small papillomata, the largest of which were about the left ureteral orifice.

Case 7. B. I. F. August 30, 1924. Aged forty-nine, married, clerk. Piedmont Hospital No. 5907.

Complaint. Catch in the right back.

Family history. Unimportant.

Past history. About fifteen years ago he had severe pains in the right side and back and was sick for about a month. An operation for fixation of the right kidney was later done and he was free of pain until five years ago when he fell while walking on some ice, and the right kidney became swollen as it is now. He was relieved of this attack by

wearing a kidney pad, which also relieved another attack which came on later. His general health has always been good though he has never been robust.

Present illness. In May, 1924, he had an attack of "Flu," and was in bed two weeks. Two weeks later he was up and about but very weak. He was at work for five weeks, and had no special pain, nor unusual symptoms. During this time he had several teeth extracted.

About a week ago he began having a "crick" in the right back whenever he moved; it was quite sharp. Ever since he had the "flu" he has noticed a swelling in the right side of his abdomen, which has remained about the same size. The pain in the back does not radiate and there has been no tenderness over the swelling. He has had a little afternoon fever occasionally since the present illness. He has had no blood in the urine nor any cloudiness. He has lost a good deal of weight. Several teeth were extracted about a month ago. He has two children living and well. His wife is well and has had no miscarriages.

Examination. The patient is a poorly nourished man. Heart: The heart beat is not seen nor felt. It is not easy to percuss out the area of cardiac dullness. The second sound over the mitral area is not heard; the first sound is replaced by a long blowing murmur, which is transmitted to the axillary region, and heard in the aortic and pulmonic areas, but less distinctly. The pulse is rhythmical, and regular, but of small volume. A large mass is felt in the left side of the abdomen extending from below the crest of the ileum to the umbilicus, and beneath the ribs. The diameter seems to be about 15 cm. (6 inches); dull to precussion smooth, no irregularities. It does not yield to pressure and is not tender. The left kidney is not felt except on deep inspiration. Blood pressure 99/55. Red blood cells 3,120,000, hemaglobin 70 per cent, white cells 13,000 (polymorphonuclears 72 per cent), small mononuclear 21 per cent, eosinophiles 2 per cent, 1 large mononuclear 4 per cent, transitional 1 per cent).

Cystoscopy and ureteral catheterization. The bladder seems normal. A 6 F. catheter passes only 3 cm. up the right ureter. A 4 F. catheter passes 12 to 15 cm. with difficulty. 'Phthalein test (intravenous): Appearance on the left four minutes, none of the right in twenty-five minutes. Output 17 per cent on the left in twenty-one minutes. There was no leakage of dye into the bladder. The microscope showed only a few epithelial cells and pus cells in the washings from the right ureteral catheter; the urine from the left catheter contained a few red blood cells and a good many epithelial cells. Twenty cubic centi-

meters of normal saline solution were injected into the right ureter without producing pain.

Pyelogram. Roentgenogram 1: Semierect position, no injection. The tip of the catheter in the right ureter is lying just below the right sacroiliac joint. A small shadow is lying along side the catheter, a few centimeters above the bladder and looks like ureteral stone. Roentgenogram 2: Injection of about 15 cc. of a 20 per cent solution of sodium iodide. At about the level of the fifth lumbar vertebra the ureter is seen to turn to the right and after making an S-shaped curve runs into the pelvis. The shadow of the pelvis filling is about 7 cm. in diameter, and hazy on the outer part. It is half-way above the crest of the ileum. The ureter is somewhat dilated.

The twenty-four-hour spedimen of urine was only 700 cc.; cloudy, alkaline, specific gravity 1015; no sugar but a good deal of albumen. Microscopically: A good many epithelial cells, a few red cells and hyaline casts; no pus and no organisms. Blood: Nonprotein nitrogen 112 mgm., urea 60 mgm. Blood culture, negative. Blood typed for transfusion: No. 1.

September 1, 1924. Blood transfusion: 500 cc. of blood by the Unger method given by Dr. H. C. Sauls, with excellent results.

September 3, 1924. Since admission the temperature has varied between 98 and 103.4, usually 100 or over, though occasionally 98.6. This was thought to be due to some infection in the kidney which was not evident in the urine.

Nephrectomy. September 3, 1924. Gas oxygen anesthesia. A loin incision was made below the line of the old scar. The kidney was found to be very adherent to the scar; in freeing these adhesions the kidney tissue was torn and there was a good deal of bleeding until the kidney was freed, and some of the urine allowed to escape from the thin walled, distended kidney. There was not much difficulty experienced in freeing the kidney after the adhesions to the lateral abdominal wall were separated, and it was removed without much difficulty, except that care had to be exercised in catching the rather widely separated vessles of the pedicle. The pelvis was greatly enlarged and protruded between the vessels in such a way that the pedicle was separated by it. The urine in the kidney was somewhat cloudy and seemed slightly bloody.

Towards the end of the operation the patient's pulse became imperceptible at the wrist, and an intravenous injection of normal saline was begun at once, and the operation terminated as rapidly as possible.

On leaving the operating room the pulse was 80, respiration 22. His lips were very pale, and he seemed very weak.

Pathological description. The specimen consists of a right kidney, which is very much enlarged. The pelvis and calcyces are so greatly dilated that the kidney substance is everywhere quite thin. On the convex border there is a thin walled cyst about 3 cm., in diameter containing clear fluid. No evidence of malignancy. The mucosa lining the pelvis and calcyes looks fairly normal. Diagnosis: Uninfected hydronephrosis of the right kidney. Probably due to an obstruction in the ureter.

Three hours after operation the patient was given a transfusion of about 400 cc. of blood by the Unger method and was greatly improved immediately.

Following the operation the patient's temperature continued to rise every day to a little above or below 100, dropping a little below normal in the mornings. This was not easy to explain for the wound was uninfected and healed quite well. He improved rapidly, felt really quite well, and was cheerful. On the fourteenth day he was allowed to sit in a chair for a short time, and during the following night, after 8:00 p.m., he seemed to be sleeping very well. The next morning he was found to have a paralysis of the right side, and was unable to talk, and did not seem to recognize any one very well. He failed rapidly and died on the twentieth day.

A postmortem examination showed an active endocarditis with quite large vegetations on the mitral and tricuspid valves, evidently the site from which the cerebral embolus broke away, and explained the fever before and after operation.

It was remarkable to observe the improvement in the patient after both of the transfusions. He was in such a bad condition that it is not likely that he would have gone through the operation without the transfusion.

Case 8. J. F. F. March 8, 1924. Aged seventy-seven, married, business man. Piedmont Hospital No. 4544.

Complaint. Increased frequency of and difficulty on urination.

Family history. Unimportant.

Past history. Unimportant, except that he has had some recurring attacks of hemorrhoids for thirty or forty years; small and not very annoying. For eight or ten years he has had a little constipation and has been taking some mild cathartic once or twice a week. The

urological history is negative, except that he had a right epididymitis after a right inguinal herniotomy seven years ago.

Present illness. About eight to ten years ago he began getting up once at night to urinate, and soon after that noticed some difficulty in starting the flow of urine. This gradually grew worse and for the past two years he has had a good deal of trouble with increased frequency and some difficulty in urination. He now voids about every two or three hours day and night. There have been no attacks of marked increased frequency of urination, but occasionally the difficulty has been quite marked. The first time he discovered a cloudiness of the urine was eight or ten days ago. He went immediately to his local physician who began giving him some treatment for the bladder trouble and then sent him to me. He has not been catheterized at all except after the hernia operation, when catheterization was necessary for twenty four to forty eight hours.

Present symptoms. A fairly good deal of difficulty in starting the flow of urine and the stream starts and stops. He voids every two to three hours. The urine is cloudy and has a bad odor. He does not feel very well—has general malaise and is nervous.

Examination. Patient is a healthy looking man of good color. Tongue coated white, breath a little bad. Urine cloudy in all three glasses and a fairly strong odor; slightly acid. Stained specimen showed many large bacilli like colon and cocci like staphylococci. No sugar but a small amount of albumen. Phenolsulphonephthalein test (intramuscular) 25 per cent in one hour; appearance time ten minutes. Blood pressure 134/78.

Rectal examination. Shows a quite marked bulging of the prostate rectalwards, suggesting prostatic hypertrophy. No induration nor adhesions suggesting cancer. Residual urine about 150 cc. (5 ounces).

Cystoscopic examination. Small observation cystoscope passed without difficulty and showed a quite large intravesical protrusion of both lateral and median lobes. There was a good deal of bleeding. The bladder was negative, except for well marked trabeculation; no diverticula; no stones.

After the cystoscopic examination it was necessary to leave a catheter in the bladder for twenty-four hours, to control the bleeding. When it was removed the patient had a chill, followed by an elevation in temperature to 101.3 and his pulse became somewhat intermittent. He was given digitalis and in a day or two he felt all right again. The 'phthalein test went up to 30 per cent in one hour where it remained during his stay in the hospital.

He was in the hospital for ten days and was treated by urinary antiseptics and bladder irrigation through a catheter. The urine remained cloudy though it was much improved in appearance and odor. The residual urine varied from 5 to 12 ounces. His general condition was much improved.

Operation was advised but he decided to go home and try treatments for a while.

In six days he returned to me bleeding severely with the bladder partially filled with clots. I had warned him that attacks of bleeding might come on at any time because the prostate protruded so far into the bladder and catheterization was a little more difficult than usual. He had been bleeding rather profusely for thirty-six hours before I saw him, and bled for forty-eight hours more in gradually decreasing amounts though the coagulation time of the blood was about four minutes and hemostatics were injected intramuscularly.

Transfusion. April 2, 1924, 500 cc. of blood from his son were given him by the Unger method. The bleeding stopped immediately and the restlessness which he had developed was relieved. Before transfusion the red blood cells were 3,300,000 and hemoglobin 75 per cent; two days after transfusion they were 4,000,000 and 80 per cent.

A *suprapubic cystotomy* was performed on April 15 under local anesthesia without discomfort to the patient. On the 16th, the temperature rose to 101, but thereafter was normal. Up in the rolling chair in three days.

The *prostatectomy* was done April 29, 1924, under gas-oxygen anesthesia. He stood the operation well and was returned to his room with a normal pulse. The prostate was quite large, evidently a benign hypertrophy. During the afternoon he bled quite a good deal from the prostatic wound, due, it seemed to a failure of the Pilcher bag to properly press upon the edges of the large relaxed wound.

No time was lost. The patient was transfused with 500 cc. of blood from his son seven hours after the operation. The Pilcher bag was then allowed to drop back into the bladder and emptied, and it was removed the next morning. There was no more bleeding.

He was allowed to step from the bed to the chair on the eighth day, and was walking everywhere on the twenty-third day. He was discharged on the twenty-eighth day, the suprapubic wound having been closed for four or five days. He felt well and strong and could walk everywhere.

When I saw him again three months later the urine was free from

shreds and infection, and the bladder capacity was normal. He passed a large stream of urine without hesitancy, and there was no residual.

While neither of the transfusions were essential in this case, they served to keep the patient in good condition. Before the first transfusion he was very nervous and apprehensive about the results of an operation, but after the transfusion he was so much impressed with what it had done for him that he lost all fear, and was thereafter an excellent patient.

Case 9. A. E. W. July 22, 1924. Aged seventy-seven, married, ticket agent. Piedmont Hospital No. 5593.

Complaint. Increased difficulty and frequency of urination.

Family history. One sister died of cancer.

Past history. He had malarial fever several years ago. He has always been delicate and has taken very good care of himself. He has had a little constipation for a good many years, but has rarely had to take medicine for his bowels. For three or four years he has had hemorrhoids. They were bad enough, about two and a half years ago, for him to have them treated by injection, but they have given him very little trouble since. There has been some backache occasionally for twenty years; not very annoying and relieved by lying down.

Present illness. Nearly all his life he has had to urinate more frequently than normal. For several years he has been urinating from two to twelve times at night. For three or four years there has been some difficulty in starting the stream, which has been weak with dribbling at the end. There has been no pain except when he had retention. About two years ago he had complete retention of the urine and had to be catheterized twice. About three weeks ago he had another attack of complete retention, and was catheterized three times.

Very often after voiding he feels as though he had not emptied the bladder, and strains for a few minutes. No incontinence of urine. The sexual powers have been fairly good up to a few months ago.

Examination. Blood pressure 160/70. Red blood cells 3,950,000, white cells 6400.

Urine: There are a few small shreds in glass one, otherwise clear. Acid: no sugar or albumen. Blood urea nitrogen 38.4 mgm. 'Phthalein test (intramuscular) 40 per cent in one hour and fifteen minutes. The knee kicks are obtained with difficulty, but the eyes react actively to light and accommodation, and the Rhomberg is negative. There is a slight inguinal hernia on the right. The tongue is somewhat coated and the breath is a little bad.

Rectal examination. The prostate bulges a good deal rectalwards, the edges being thickened and almost overhanging in the lower part. The seminal vesicles and vasa are not thickened. There is no evidence of malignancy. The seminal vesicular and prostatic secretions contained a good many pus cells; no organisms.

Cystoscopic examination. No residual urine; bladder capacity 400 cc. The bladder is somewhat trabeculated and there is a small diverticulum on the left lateral wall. The median lobe protrudes well out into the bladder with a deep cleft on either side, but there is no cleft above in the mid line. With the cysto-urethroscope the lateral clefts are seen to be very deep, and the verumontanum is found much further from the bladder than usual.

After nine days in the hospital the patient seemed improved; his breath had lost the unpleasant odor, and his tongue was clear.

Suprapubic prostatectomy. August 1, 1924. Gas-oxygen anesthesia. The usual operation was performed, beginning the enucleation intraurethrally. A medium sized enlargement was removed without difficulty. There was quite a good deal of bleeding which was stopped at once by the Pilcher bag. The patient stood the operation well and was returned to his bed with the pulse 92, and the respiration 20.

Pathological report on the prostate. Chronic prostatitis and benign hypertrophy.

The bleeding continued after the operation. The pulse became weaker and slightly irregular and in three or four hours was 120. He was transfused with 500 cc. of blood that evening (Dr. H. C. Sauls; Unger Method) and the Pilcher bag was removed. The pulse rate dropped to 96 and the bleeding stopped almost completely.

For the first few days after operation the temperature was 100 to 102; after the fifth day 99 to 99.8 most of the time. The bleeding, which was very little for a day or two after the transfusion, began to increase again, so on the eighth day he was given another transfusion of 500 cc. of blood. There was some nausea and a little vomiting during the day after the transfusion, but no chill and no unusual elevation of temperature. There was a good deal of improvement in his general condition and the next day he ate a better breakfast than he had been eating. On the ninth day the blood was red cells 2,890,000, hemoglobin 82 per cent (Dare). There was still a little bleeding from the bladder.

From the ninth day he gradually improved, and the bleeding stopped. There was a rise in temperature to 100 or a little less every day until the thirty second day; after that it was less but there was a slight elevation above normal every day until the forty second day.

On the twenty-fifth day his left leg began to swell and I then recognized that he had a thrombosis of some of the pelvic veins. On the twenty-sixth day he was given an intravenous injection of 40 cc. of a 0.5 per cent solution of gentian violet. There was no reaction worth recording.

He gradually improved and was discharged, with the suprapubic wound almost healed, on the sixty-eighth day (October 6, 1924).

I saw the patient again November 10, 1924. The suprapubic wound healed in three or four days after leaving the hospital and has remained closed. At about the time that the wound closed he developed a left epididymitis, which was annoying for several days. He has been voiding about every two hours since the wound closed.

An examination showed the urine to be a little cloudy and to contain a few pus cells and a few organisms like colon Bacilli. The left seminal vesicle was slightly thickened and the seminal vesicular secretion contained a good many more pus cells and bacilli than were found in the urine. There was no residual urine and he passed a good stream.

The continued bleeding in this patient was most probably due to a congestion which resulted from the thrombosis of the pelvic veins. I do not believe that the transfusions had anything to do with the formation of the thrombosis, but they did assist in stopping the bleeding and improved the patient's condition considerably.

Case 10. T. J. L. September 27, 1924. Aged seventy-seven married, real estate agent. Piedmont Hospital No. 6869.

Patient came to me because he was unable to void. He had been having a good deal of increased frequency of and difficulty on urination for several months, and had been treated by three or four different doctors, with medicines and catherization, and when I first saw him he was wearing a retention catheter. Cystoscopic examination showed a fairly large intravesical protrusion of a hypertrophied prostate. The bladder was moderately trabeculated and the urine infected with colon bacilli.

'Phthalein test (1 cc. intramuscular) appeared in thirteen minutes; the output for the first hour through a catheter was 19 per cent, the second hour 15 per cent. The general physical condition showed nothing of importance, except some bad teeth. Nonprotein nitrogen 37.5 mgm., urea 21.4 mgm.

Suprapubic cystotomy. September 30, 1924, with local anesthesia and gas-oxygen. A Pezzer catheter was left in the wound until the prostatectomy was performed. Recovery was uneventful.

October 6, 1924. Non-protein nitrogen 9.3 mgm., urea 12.9 mgm.

January 25, 1925. Readmitted to the hospital for prostatectomy. The blood showed 4,480,000 red blood ceslls and 98 per cent hemaglobin (Dare) Blood urea nitrogen 15 mgm. Blood pressure 139/78. 'Phthalein test (intramuscular)—first hour 33 per cent, second hour 14 per cent.

Suprapubic prostatectomy. January 27, 1925. Ethlyne anesthesia. There was nothing unusual about the operation except that there was a good deal of bleeding from the abdominal walls, the bladder, and from the prostatectomy wound. Operation was a little longer than usual because complete relaxation was not obtained by the anesthesia. He stood the operation well, however, and was returned to his room in good condition, where he was given 200 cc. of normal salt solution intravenously.

The pulse rate on return from operation was 108, respiration 24. The Pilcher bag was loosened and allowed to fall back into the bladder two and a half hours after operation. The bleeding continued somewhat after the bag was loosened. Since he showed both in his appearance and by his pulse evidence of having lost a good deal of blood, he was given a transfusion of 500 cc. of blood by the Unger method four hours after operation. The bleeding stopped in a very short time.

There was a little nausea and vomiting during the afternoon, but more likely due to the anesthsia than transfusion. There was no evidence of any reaction from the transfusion.

The patient was allowed to walk on the eleventh day. The suprapubic tube was removed on the twenty-second day and the wound remained completely dry after that.

Recovery was satisfactory and fairly rapid. I am satisfied that the transfusion was of great assistance in getting him in good condition so rapidly after the operation.

Case 11. A. J. I. October 12, 1920. Aged sixty-two married, farmer. Piedmont Hospital No. (1920) 343.

Complaint. Difficult and frequent urination.

Family history and past history. Unimportant.

Present illness. He has been getting up at night to void for about twenty years. This has gradually grown worse and lately he has been voiding about every hour during the day and eight to ten times at night. During the past two years he has had a good deal of difficulty in voiding and there has been some burning on urination. The urine has been cloudy for a year, but has contained no blood. About two weeks ago

he had complete retention of urine and has had to be catheterized ever since, and has been irrational at times.

Examination. The patient is a rather anemic man, 6 feet 7 inches tall. There is some irregularity of the pulse but the heart seems to be fairly normal; moderate emphysema.

Residual urine 600 cc., bladder capacity 1220 cc. The urine is quite cloudy and contains a large amount of mucous and pus, and many staphylococci. The prostate bulges rectalwards a good deal, but there is no evidence of malignancy.

Cystoscopy. There is a great deal of trabeculation of the bladder, and a diverticulum of the left lateral wall of the bladder beyond the ureteral ridge, with an orifice about one centimeter in diameter. The prostate bulges moderately into the bladder, and there is a cleft above on the left which is fairly deep and another on the right, not so deep. There are no tumors or stones.

'Phthalein test (intramuscularly), 40 per cent in the first hour.

Suprapubic prostatectomy. November 2, 1920. There was nothing unusual about the operation, which the patient stood very well and returned to his bed with a pulse rate of 68.

After the operation the patient had a good deal of nausea, and was restless, and inclined to be irrational for a few days. On the eighth day he was getting along so well that he thought that he did not need a nurse and in the evening discharged her without my being notified. That night he managed in some way to shut off the drainage through the suprapubic tube, overdistended the bladder, and had a severe hemorrhage. He became very pale, and the pulse was weak and intermittent. On the tenth day he was given a transfusion of 500 cc. of blood by the citrate method, and was improved very noticeably at once. A Hagner bag was put in through the suprapubic wound before the transfusion and removed in an hour or two afterwards. There was no more bleeding.

Before the hemorrhage he had had very little fever indeed, but for four or five days afterwards he had a temperature of 101 or over at times. After that it was normal.

He was up in a chair on the eighteenth day and walked on the twenty-fourth day. On the twenty-fifth day he had an epididymitis with fever as high as 102 for a day or two.

He was discharged on the thirty-first day, seemingly doing very well. The suprapubic drainage tube was left in with the idea of draining the bladder in that way for sometime, and giving him an opening through which he could do his own bladder irrigations.

The final result of the operation was good. He died of "carcinoma of the throat" in 1923.

Case 12. W. C. January 17, 1924. Aged forty-nine. Single, farmer. Piedmont Hospital No. 6581.

Complaint. Slight burning after urination.

Past history. Negative, except for a double herniotomy operation in 1920.

Present illness. For about twenty years has had some slight burning on urination, principally in the perineum where he also felt some tenderness on pressure. He has been treated by one or two very good urologists, but the trouble has always returned after being relieved by treatment.

Examination. Showed a patient with an unusual muscular relaxation for his age. Tongue badly coated white in the middle and posterior part. An x-ray examination of teeth was negative. There was a little puffiness under the eyes and the urine showed a few shreds in glass one, and slight amount of albumen. There was a distinct chronic inflammation of the prostate and seminal vesicals and some thickening of the left seminal vesical. He was treated by me for a couple of months, and seemed to have been improved somewhat.

In December, 1924, he returned complaining of much the same trouble which he had been having. *Cystoscopic examination* showed a slight, but distinct median bar and an atony of the muscles of the bladder, just like that of the other muscles of the body.

Punch operation with the Caulk cautery punch. January 20, 1925. This was followed by very little bleeding and an 18 F. catheter was left in the urethra.

During the night after the operation the catheter stopped draining and when opened up by the house physician, 400 cc. of urine were found in the bladder. After this the patient suffered with some fullness in the bladder, for eight or ten days. He had a little fever occasionally in the afternoons, but showed no definite symptoms which were suggestive of any marked trouble, except occasionally he had a slight amount of active bleeding which seemed to distend the posterior urethra and even fill the seminal vesicals as well. This was discovered by emptying the vesicals by pressure by rectum.

January 31, 1925, the patient developed a great deal of discomfort in the bladder and there evidently were some large clots there which could not be emptied out through the cystoscope, or by any other means

at my command. There was active bleeding from the urethra; the patient strained trying to void every few minutes and each time passed some bright red blood with a small clot. Through a suprapubic cystotomy wound I found the bladder greatly distended with dark blood clots and there was a very active bleeding from the wound made at the punch operation. This could not be controlled by sutures, so the posterior urethra was packed with gauze.

Since the patient showed very marked evidence of having lost a great deal of blood and since the bleeding still continued, I had him given 500 cc. of blood by the Unger method, an hour or two after the operation. About an hour later the gauze wicks were pulled out of the urethra and the patient made a gradual and almost uneventful recovery. He was very much improved by the transfusion, which brought the color back to his face and lips, and improved the condition of his pulse materially.

He was discharged on the thirty-third day having made a slow recovery, due to his naturally poor physical condition.

I feel sure that his convalescence was greatly shortened by the transfusion and I know that it helped materially to stop the bleeding from the neck of the bladder since there was very little bleeding after the transfusion in spite of the fact that the packing was removed from thee posterior urethra shortly after the transfusion.

Case 13. G. M. B. August 22, 1924. Aged sixty-nine, widower, white. Grady Hospital No. 24092.

The patient was admitted to the Hospital passing blood through the urethra and through a suprapubic wound, which had been made at another hospital two weeks before as a preliminary step to prostatectomy. He had been bleeding and passing a good many clots for two days. His temperature was 103, and he complained of nausea.

Cystoscopy. The prostate could be seen projecting well out into the bladder, with a deep cleft at the vesical orifice in the mid line below. The bleeding point or points could not be located.

The prostate bulged rectalwards quite a good deal on both sides. There was no evidence of malignancy. Blood urea 18.1 mgm. Wassermann, negative. White blood cells 10,600 (polymoyphonuclears 85 per cent, small mononuclear 12 per cent, eosinophiles 1 per cent, large mononuclear 2 per cent). Since it was not possible to stop the bleeding by hot irrigations, or medicines injected into the bladder he was operated upon.

Suprapubic prostatectomy. August 23, 1924. Gas-oxygen anesthesia. The prostate was removed without difficulty, and the bleeding controlled completely with a Pilcher bag. Before operation the pulse was 88 to 108, and afterwards 116.

The day after operation he was transfused with 350 cc. of blood by the Unger direct method. Before the transfusion the pulse was about 100, afterwards it dropped to 84 and stayed below that thereafter.

The convalescence was unusually good. He had very little fever after the transfusion. He was up in a chair on the seventeenth day. On the twenty-second day he was voiding, with the suprapubic tube cut off for several hours at a time. On the eighteenth day he had an epididymitis which rapidly subsided. The suprapubic wound closed on the thirtieth day, and he was discharged on the thirty-eighth day, with a good bladder capacity no residual urine, and a 'phthalein output of 45 per cent the first hour.

While transfusion was not essential here, I feel that it did a great deal to lighten and shorten the patient's convalescence.

Case 14. J. C. D. August 15, 1922. Aged thirty-three, married, shipping clerk. Piedmont Hospital No. 1906.

Complaint. Blood in the urine.

Family history. Unimportant

Past history. Malarial fever about eight years ago. At the age of six he fell under a wagon and broke his jaw, and lost the sight of the right eye and the hearing in the left ear. Several years ago he had some severe headaches in the left temporal region but they have gradually grown better. Some hemorrhoids and some chronic constipation for five or six years. He has been married for two and a half years. One child living and well; one miscarriage at three months, cause unknown.

Present illness. In 1912, ten years ago, he had some blood in the urine which was unaccompanied by symptoms. Since then he has had some bleeding once or twice a year. This grew more frequent until during the last year or two he has had blood in the urine all the time; sometimes a good deal and sometimes the urine is only slightly colored. No pain or burning, nor other urinary symptoms. No cause for the bleeding as far as he knows. The loss of blood has produced some weakness, but otherwise he is seemingly well.

Examination. The urine is quite bloody in all three glasses; a bright red. There is no sugar; reaction acid. Microscopic examination shows

a large number of blood cells but no organisms nor other pathological elements. No parasite eggs. 'Phthalein test: 6 mgm. intravenously, collected by voiding; 38 per cent in twenty-five minutes.

Cystoscopic examination. The bladder seems to be normal, and there is no blood seen in the urine coming from the ureteral orifices. Some blood is seen coming from the urethra about the cystoscope. The urethra shows no tumors nor ulcerations, and there is no marked inflammation anywhere. To the left of the verumontanum there is a freely bleeding point. The bleeding is sufficient to interfere with a thorough inspection.

Rectal examination. Shows nothing of importance, and there is nothing abnormal found in the abdomen nor in the external genitalia. Wassermann, negative. Blood coagulation time four minutes.

Ureteral catheterization. 'Phthalein test (6 mgm. intravenously). Time of appearance about five minutes on both sides. Output in twenty minutes: Right 13 per cent, left 16 per cent. A 28 F. sound passes into the bladder without difficulty.

September 9, 1922. The patient has continued to pass bloody urine. The afternoon the temperature is always 99 or a little over. Careful examinations show no evidence of tuberculosis. He has only been taking urotropin recently. The lateral walls of the prostatic urethra were burned superficially with a fulgurating electrode through the cysto-urethroscope. The bleeding was only slightly checked.

February 27, 1923. The posterior urethra has been dilated with a Kollman dilator without any improvement. The bleeding areas in the posterior urethra were again burned with the fulgurating electrode through the cysto-urethroscope.

March 4, 1923. For four days the patient has been in the hospital wearing a retention catheter; there has been only a slight amount of bleeding, but the temperature has been 99.5 and 100 in the afternoons. Blood: Hemoglobin 40 per cent, red cells 2,225,000.

March 9, 1923. The posterior urethra was thoroughly fulgurated today in all places where there seemed to be any bleeding, and the patient was transfused with 500 cc. of blood by the direct method by Dr. H. C. Sauls.

March 12, 1923. There was no reaction to the transfusion. Yesterday the temperature was 100 nearly all day, rising to 101.4 in the afternoon. There is almost no fever today and the patient feels better. The bleeding has stopped.

Discharged from the Hospital March 15, 1923, seemingly well.

June 6, 1923. The patient has been well since he left the Hospital. There has been no bleeding, and he has gained in weight and strength.

There was a little dilatation of the superficial vessels of the prostatic urethra, most marked just this side of the vesical orifice. Though I destroyed most of the mucosa over these areas with the fulgurating electrode I was not able to stop the bleeding without the transfusion, which also served to replace some of the blood which has been lost by the bleeding.

Case 15. D. M. W. May 22, 1924. Aged fifty-three, married, deputy sheriff. Grady Hospital No. 22696.

Complaint. Bleeding from the bladder.

Family history. Mother died at seventy-six of cancer of the womb. There was a tendency in all the family to nose bleed.

Past history. Unimportant.

Present illness. Began twenty years ago with pain at the neck of the bladder, mostly at the beginning of urination. There was some blood in the urine and a considerable increase in the frequency of urination. He had attacks of that kind frequently for a year and then no more until three and a half years ago. He then had a sudden attack of pain in the bladder and hematuria. From then until a suprapubic cystotomy two and a half years ago he had blood in the urine constantly and a marked increased frequency of urination. I first saw him about two and a half years ago, and at cystoscopy found the bladder practically filled with papillomata. On opening the bladder suprapubically I found papillomata covering the whole mucosa of the bladder and seemingly extending into the prostatic urethra. I removed as much of it as possible, and closed the bladder about a suprapubic drainage tube which he wore from then on. Between that time and the time he was admitted to the hospital (May 22, 1924) he received treatments of radium in the bladder, deep x-ray therapy, and a great number of fulgurations of the bladder tumor by which the urethra and most of the bladder about the trigone and vesical orifice was freed of tumor. However, it was impossible to clean up the more distal parts of the bladder, and the bladder eventually became so contracted that it was impracticable to work in it with a cystoscope.

There has been some bleeding at times, but most of the time the patient has been fairly comfortable and continued his work, which, however, has been made lighter for him. About a week before entering the hospital he began to have a good deal more bleeding. He had

already been getting a good deal weaker and this was sufficient to weaken him so that he stayed in bed.

On admission the urine contained a good deal of pus and blood, and numerous organisms like colon Bacillus; it was alkaline and of a bad odor. Red blood cells 1,568,000; white blood cells 7,100. Wassermann, negative.

May 24, 1924. Blood transfusion: 500 cc. of blood by the direct method. No reaction. On admission the temperature was 97, pulse 90, and respiration 20. Nearly every afternoon the temperature rose to 99.3 to 100. The pulse remained 86 to 100. The transfusion seemed to produce some improvement in his general condition, but the pulse and temperature were unchanged.

June 7, 1924. Blood transfusion: 500 cc. of blood by the direct method.

June 12, 1924. Fifty milligrams of radium were left in the bladder (through the suprapubic opening) for seven hours.

The patient died of carcinomatosis on June 22, 1924, having gradually grown weaker, the amount of blood in the urine, the temperature, pulse and respiration remaining about the same until nearly the end.

Of course one cannot expect to obtain very much benefit in a patient having so extensive a carcinomotosis. It is interesting to note, however, that the transfusion did not seem to effect the bleeding very much.

Case 16. G. W. P. August 16, 1924. Aged sixty-six married, white, night watchman. Grady Hospital No. 24000.

Complaint. Inability to urinate.

Family history and past history. Unimportant.

Present illness. For several years the patient has been having some difficulty in urinating and some increased frequency of urination. Yesterday he had a complete retention of urine.

Examination. On admission he was catheterized to relieve the complete retention of urine. The urine was cloudy, and contained some pus and some staphylococci. A small amount of albumen, no sugar. The prostate was much enlarged by rectum, and the cystoscope showed a moderate middle and lateral lobe enlargement into the bladder. Moderate trabeculation of the bladder; no tumors and no stones.

August 17, 1924. Patient has been voiding some; residual urine now 30 cc. bladder capacity 300 cc.

Blood pressure 128/70. Blood urea 18.1 mgm. The lungs seem clear and there is no hypertrophy of the heart and no murmurs. Pulse regular.

Blood: white blood cells 9,150 (polymorphonuclear 70 per cent small mononuclear 24 per cent, eosinophiles 1 per cent, large mononuclear 2 per cent, transitional 3 per cent).

Perineal prostatectomy. August 23, 1924. Gas-oxygen-ether anesthesia.

The usual Young perineal prostatectomy done. No unusual difficulties were encountered except that there was more bleeding than usual from the periprostatic vessels. The lateral cavities were packed tightly with gauze, and a large tube left in the bladder. Before the operation the pulse was 80, after operation 100, respiration 20.

Second day: There was some bleeding from the wound and some blood in the urine, coming through the tube, yesterday and this morning. Today the packing was loosened, and later removed. This afternoon the patient was transfused—300 cc. of blood by the citrate method. The transfusion had to be stopped because the patient became chilly and nauseated.

On the fourth day the patient was still somewhat nauseated, and there was still a slight amount of bleeding. Blood urea 60 mgm.

There was no elevation in temperation above normal after operation but the pulse varied between 80 and 90; repsiration about 20. He remained quite weak, was nauseated and could not take nourishment. He was given normal saline solution frequently by intravenous injection and by hypodermoclysis.

A few days after operation he began to complain of a pain in the chest, which at times, was rather severe. On the eighth day a pleurisy was discovered in the lower right chest, and the hands and feet were discovered to be slightly swollen. The blood urea was 42 mgm. on the sixth day.

On the sixth day another transfusion by the Citrate method with a different donor was tried, but after 250 cc. of blood were given it had to be stopped on account of the patients becoming chilly, nauseated, and vomiting.

On the tenth day the blood urea was 40 mgm., red blood cells 2,790,000, hemoglobin 50 per cent white blood cells 12,150. Blood pressure 150/60, and the patient was semiconscious at times.

On the eleventh day another transfusion by the Unger direct method was tried with a different donor, but after only 60 cc. of blood he began to vomit and died shortly afterwards.

The *pathological report* on the prostate removed was: Benign hypertrophy with some chronic inflammation.

An autopsy showed about 1500 cc. of a clear, straw colored fluid in the abdomen cavity. There was a chronic cirrhosis of the liver, which was enlarged and firm. The kidneys were large and soft, and a number of small cysts were found in the right. Weight: Right 390, left 310. The pericardial sac contained a good deal more fluid than it should. The heart was about normal.

There was a clear straw colored fluid in both chest cavities, and some chronic tuberculosis in the upper part of the left lung. The right lung showed a fibrinous pleurisy in the lower part, some scattered tubercles in the lower lung tissue, some small cavities in the central part of the lung, and a chronic tuberculosis in the upper part. There was some enlargement of the glands about the bronchi.

The transfusions in this case were all seemingly detrimental. The bloods were carefully matched, and three different donors were tried. It is possible that the patient would have recovered if there had been no reactions, to the transfusions, and he could have obtained a suitable amount of blood to replace that lost at operation and afterwards. The tubercular condition was sufficiently inactive to warrant our believing that he was able to stand an operation. This is borne out by there being no fever before or after operation until the ninth day, except immediately after operation when the temperature went to 99.2.

Case 17. A. M. A. July 5, 1924. Aged seventy, married, Grady Hospital No. 23981.

Complaint. Unable to pass urine.

Family history. Two brothers died of "kidney trouble." Otherwise negative.

Past history. Unimportant, except for jaundice twenty years ago following a carbuncle on his neck; no pains. Has had no sexual ability for eight or ten years.

Present illness. Began about seven years ago with an increased frequency of urination; he began to void from one to eight times at night, more often than normal during the day. There was a slight stinging pain at the end of the penis just before the stream of urine started. There has been some urgency at times during the past seven years, less marked during the past few months. The difficulty in voiding has gradually increased somewhat during the present illness, and six days ago he had complete retention and had to be catheterized. He has not voided since that time.

Physical examination. The heart is slightly enlarged to the left; no

murmurs. The pulse is regular in force and rhythm. The reflexes are normal.

Rectal examination. The prostate bulges rectalwards a great deal. The lateral borders are a good deal thickened and quite steep. No adhesions and no suggestion of malignancy. The seminal vesicles are not felt.

Cystoscopic examination. The meatus was enlarged from 20 F. to 30 F. The bladder is a good deal trabeculated. The prostatic urethra is very long (a large extravesical enlargement of the lateral lobes). There is a moderate intravesical protrusion of the middle and lateral lobes.

The urine contained a few red blood cells, and a moderate amount of pus and some organisms which resembled colon Bacilli. No sugar. Phthalein test: 6 mgm. intramuscularly; output in the first hour 50 per cent. Blood urea 10 mgm.; blood coagulation time five and one-half minutes. Wassermann, negative.

For the first few days after admission catheterization was necessary practically all the time, but in a few days he began to void and in a few more days he was able to pass all the urine except 5 or 6 ounces. He seemed rather despondent, and although he appeared to be in good physical condition it was decided to defer the operation until he was feeling brighter.

He returned to the hospital August 12, 1924. The blood urea was 16 mgm., the 'phthalein test 48 per cent the first hour, and 15 per cent the second. The urine was still infected with colon Bacilli and contained a moderate amount of pus. He was having a good deal of difficulty in voiding but seemed to empty the bladder fairly well. Another careful physical examination showed nothing abnormal for a man of his age.

Perineal prostatectomy. August 30, 1924. Gas-oxygen-ether anesthesia. The usual perineal prostatectomy of the Young type. The prostate was quite large (85 grams), and there was a little more bleeding than usual. He stood the operation well and was returned to his bed with a pulse rate of 104, respirations 20 to the minute.

Pathological report on the tissue removed: Non-malignant adenoma of the prostate.

A few hours after operation the patient's pulse became weaker and it was found that he was bleeding through the tube left in the bladder. At 8:00 p.m. he was transfused—given 500 cc. of blood by the direct method. His extremities were cold when the transfusion was started

and the pulse rate was 128. After the transfusion he was greatly improved; pulse 92. The next day the red blood cells were 3,920,000 and the hemoglobin 60 per cent. On the fifth day the blood pressure was 160/70 and he was seemingly doing very well. There was almost no bleeding after the transfusion, but he seemed weak and once or twice seemed confused and tried to get out of bed. The wound looked good, and there was no fever. On the eighth day he was up in a chair for a short time. Blood urea 25 mgm.

On the tenth day he was again transfused being given 500 cc. of blood by the direct method. This was done because he seemed to be growing weaker though no definite cause for his lack of improvement could be found. He seemed despondent, and at times would refuse nourishment, at other meals he ate fairly well. There was no fever until the morning of the eleventh day when the temperature was 99. After the transfusion he seemed brighter and the next morning ate a better breakfast.

A careful physical examination was made on the twelfth day and nothing unusual found. He was irrational at times. From then on he gradually grew weaker, began to hiccough, and there was an elevation of temperature above normal. He died on the fifteenth day.

A postmortem examination was, unfortunately, not obtained, and we were not able to explain the patient's failure to respond to the transfusions and other medicinal measures which we tried. There was no reaction to the transfusions, no fever, no blood retention, and the heart and lungs seemed to be functioning normally.

Case 18. C. M. November 30, 1920. Aged seventeen, single, clerk.

Complaint. Blood in urine for a month.

Family history. Unimportant.

Past history. For a good many years he has had an intermittent discharge from the left ear and the hearing in this ear is diminished. Thinks that he has had catarrh of the nose and throat all of his life.

Present illness. About three years ago he passed some blood in the urine without any urinary or other symptoms. There were no clots in the urine and the bleeding lasted only a few days. Since then he has had three or four similar attacks. About three or four weeks ago the bleeding began again, and the attack was like the others, only this time it has not stopped. About two weeks ago he began having a dull, aching pain over the bladder; intermittent, and not made worse by exercise.

There have been no other symptoms, except that for the past few days he has had some nausea in the mornings, and recently he had noticed some clots in the urine.

Examination. The urine is a dark red color, free from infection, and sugar. He is rather anemic, and there is a marked acne vulgaris on the face and body. The cystoscope shows a reddening of the trigone and red, bullous like swelling about the vesical orifice. There is a slight swelling of the right ureteral orifice; the left orifice is slit like. The urine from the right side seems to be clear, that from the left quite bloody. A pyelo-ureterogram on the left showed a dilated kidney pelvis and ureter. There does not seem to be any enlargement of the kidney, and but for an enlargement of the ureter in the bony pelvis the ureter and pelvis seem to be normal. A total 'phthalein test gives 39 per cent for the first hour and 16 per cent for the second. Fifteen minutes were allowed for appearance time. A differential 'phthalein test (intramuscularly) showed an appearance time on both sides of about fifteen minutes, and an output of 17 per cent on the right, and 15 per cent on the left in one hour.

A double pyelogram done on February 23, 1921, showed a great dilatation of both ureters with considerable irregularity in their course to the bladder. Both pelves are dilated and there is a dilatation and shortening of the major and minor calyces.

During the time from when he first came to see me up to operation, March 5, 1921, careful examinations were made to determine the cause of the bleeding without avail, except that he had a slow blood clotting time—ten and one-half minutes. The left kidney was injected with adrenalin chloride (3 to 6 cc. of a 1:1000 solution) and with one per cent solution of silver nitrate. He was given calcium lactate by mouth. On January 22, 1921, he was transfused by Dr. H. C. Sauls—500 cc. of blood by the sodium citrate method. Nothing I did has much effect on the bleeding and the transfusions only checked it for a few days. His general physical condition remained pretty good, and he gained some weight. Before operation the coagulation time dropped to about three minutes.

Nephrectomy. March 5, 1921. Gas-oxygen anesthesia. An attempt was made to examine the kidney through a nephrotomy wound, but the bleeding was very bad, and when the wound was sutured, the bleeding still continued. The kidney was, therefore, removed.

The patient stood the operation well, the pulse going only a little above 80, and he was awake before he reached his bed.

Convalescence was uneventful, and he was discharged on the twenty-sixth day. The function ('phthalein) of the remaining kidney was 32 per cent in the first hour, and 15 per cent in the second. Coagulation time of blood—two minutes.

An examination of the kidney failed to show any definite cause for the bleeding. There was some reddening and swelling of the mucosa of the calyces and pelvis, but no varicosities, nor areas of actual inflammation. No tuberculosis (Laboratory Dr. John Funke, Atlanta).

In January, 1922, the patient wrote me that he had had an attack of hematuria lasting about two weeks, and stopping without interference. Again in January, 1922, there was some bleeding for a few days, due, he thought, to putting turpentine on a cut on his foot.

In November, 1922, he returned with an attack of cystitis, the urine containing a good deal of pus and some streptococci. This cleared up under a little treatment—bladder irrigations and hexamethyleneamine.

In April, 1923, he had another attack of cystitis. There was an infection of the right kidney with colon Bacilli. The urine remained cloudy for a month or two though he was taking acid sodium phosphate and hexamethyleneamine. After that he has remained well. I saw him in July, 1924. The 'phthalein test showed an output of 36 per cent in one hour, and the urine was clear, but contained a moderate amount of albumen. Coagulation time of blood three and one-half minutes.

This is an interesting case of renal hematuria, the cause of which could not be explained. It is not entirely due to the slow coagulation time for he continued to bleed after the coagulation time became three minutes. I am reporting it here because of the fact that the bleeding was not checked by transfusion.

CONCLUSIONS

My experience with transfusions of blood lead me to advocate very strong y their use in genito-urinary surgery. Not only for the purpose of saving life in an extreme emergency, but also to assist in carrying patients safely through operations by giving them needed blood before operations, and to mitigate the symptoms due to a loss of blood and shock. Having available so efficient a procedure for these purposes has given me an added confidence in handling these serious cases which I am sure will not prove unfounded.

SURFACE TENSION

THE CLINICAL SIGNIFICANCE OF A NEW FACTOR IN URINARY ANTISEPSIS SUGGESTED BY CERTAIN EXPERIMENTAL OBSERVATIONS WITH HEXYLRESORCINOL

VEADER LEONARD AND MARTIN FROBISHER

From the Department of Bacteriology, School of Hygiene and Public Health, Johns Hopkins University

Regardless of the question of the tenability of Ehrlich's elaborate hypotheses on the mechanism of the vital processes, the epoch-making influence of his original conception has converted the trend of modern thought from empiricism to an attempt at least, to interpret biological phenomena in terms of chemical reactivity.

Disinfection has come to be regarded in the light of a chemical reaction between the cell protoplasm and the disinfecting substance. In fact, Harriette Chick (1) has proved conclusively that disinfection is an orderly time process, exhibiting all of the mathematical characteristics of a chemical reaction of the first order—a so-called unimolecular reaction. With this conception in mind it is not surprising that the chief factors which have long been known to control the velocity and completeness of a chemical reaction, namely, concentration, temperature, pressure, and time, should also have long been known to determine the rate and efficiency of disinfection by chemical means.

Were we dealing with naked protoplasm in the test tube, the factors enumerated above would probably be found to control the process of disinfection as completely as any ordinary chemical reaction. Even in a consideration of the mechanism of chemical disinfection in the test tube, we are confronted by the complicating factor, however, that one of our reagents (the cell protoplasm) is separated from the other (the disinfecting substance) by a membrane which may be more or less of a physical barrier

to the promptness and completeness of the chemical reaction which otherwise might be expected to take place. Under the circumstances it is clear that the diffusion of the disinfecting substance through the cell membrane of the organism is essential to the reaction which results in disinfection. It is equally clear that such phenomena as staining, bacteriostasis and nutrition must be controlled by diffusion as the only means of communication as between the living protoplasm and its environment.

Now it is a demonstrated fact (2) that by lowering the *surface tension* of a solution of sugar, for example, the *rate of diffusion* of water through the semipermeable membrane containing it, is increased. As stated above, diffusion of the disinfecting substance through the cell membrane of the organism is probably an essential preliminary to the destructive chemical reaction with the protoplasm which results in the death of the cell. It seems logical to assume therefore that any factor, such as lowering the surface tension, which increases the rate of that diffusion must play a part in the process of chemical disinfection. It seems logical therefore to assume that a germicide which itself lowers the surface tension of its solvents should owe a portion of its bactericidal power to that fact.

In a future communication experimental data in support of this view, will be presented, showing the intimate relationship between the bactericidal properties of a series of homologous substances and their power to reduce surface tension, as determined by their chemical constitution. Suffice it to say at present that, among the alkyl resorcinols, hexylresorcinol, the most powerful germicide of the series, is also a very powerful surface tension reducent. This interesting substance which is by far the most effective phenolic germicide ever described compares favorably, in its power to reduce surface tension, with chemically pure sodium oleate (fig. 1).

In considering the factors influencing the disinfection of surfaces, such as mucous membranes, presenting innumerable microscopic crevices, in the depths of which organisms may lurk, the surface tension of the disinfecting solution may largely determine its efficiency.

The ability of solutions of low surface tension to penetrate or "seep" into minute crevices is a well known physical fact. For example it is familiarly observed that oils may soak completely through thick wooden planks. Alcohol will readily and extensively be absorbed by substances such as fabrics, upon the surface of which water will remain as droplets. Upon touching these droplets, however, with a glass thread moistened with any

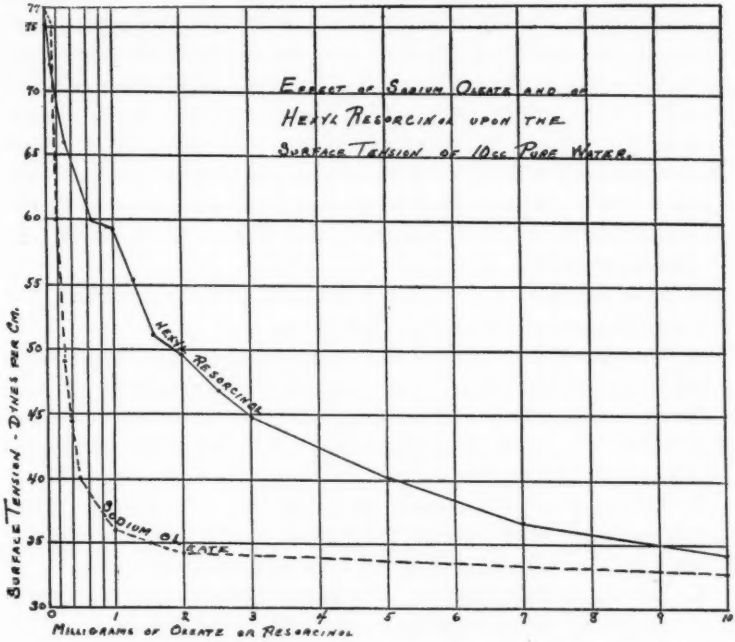

FIG. 1. HEXYLRESORCINOL AS A SURFACE TENSION REDUCENT

surface tension reducent such as alcohol, oil or soap solution, they are observed to be quickly absorbed. Many other familiar phenomena might be cited in evidence of the fact that fluids of low surface tension are better able to penetrate into microscopic pores or spaces than fluids of high surface tension. The explanation lies in the fact that the strong retaining surface film of the fluid

of high surface tension prevents its extension into the depth of a microscopic crevice whereas the readily extensible surface film of a fluid of low surface tension allows a labile pseudopod-like process to flow readily into that crevice and even into its tiniest ramifications. This property is commonly referred to in the literature on disinfection as "penetrability."

Our interest in the possible application of the foregoing considerations of surface tension as a controlling factor in disinfection became aroused in attempting to determine the true explanation of some very puzzling experimental observations in connection with the efficacy of hexylresorcinol in acid and alkaline urine (3 and 4). This investigation, which was undertaken at the suggestion of Dr. Percy D. Meader, has not only resulted in a full explanation of the facts observed but has also led us to believe that at least two procedures commonly employed as a routine in the treatment of chronic infections of the urinary tract are subject to careful revision.

A brief enumeration of the experimental facts observed will serve to illustrate the problem before us.

1. Hexylresorcinol retains its bactericidal properties in vitro when dissolved in human urine, *regardless of the reaction.*

2. The urine secreted by rabbits and by normal men, receiving this substance by mouth, may possess bactericidal properties *regardless of the reaction.*

3. The acid urine ordinarily secreted by normal men taking hexylresorcinol and proved to possess bactericidal properties retains its bactericidal perperties *when titrated to alkalinity.*

4. Yet the administration of sodium bicarbonate to normal men receiving hexylresorcinol *completely robs the urine of its bactericidal properties.*

5. On withdrawal of the soda and continuance of the hexylresorcinol, the reappearance of bactericidal urine *is practically coincident with the reappearance of acid urine.*

Clearly, hexylresorcinol retains its bactericidal properties in solution in human urine of any reaction, whether the crystals are dissolved directly in that urine or whether the drug has passed through the body and appears in the urine through excretion by the kidney.

TABLE 1

Surface tension normal urine

Based on 50 determinations at various hours

SUBJECT	<°t	SURFACE TENSION
		dynes
I. J. C.	87.27	59.4
II. E. C.	87.73	59.7
III. C. B.	88.00	59.9
IV. C. K.	91.60	62.4
V. V. L.	94.14	64.1
Average	89.75	61.2

TABLE 2

The surface tension of the urine of normal men taking therapeutic doses of hexylresorcinol

Based on 95 determinations at various hours

SUBJECT	NORMAL <°t	NORMAL SURFACE TENSION	HEXYL <°t	HEXYL SURFACE TENSION
		dynes		*dynes*
J. C.	87.27	59.4	72.75	49.5
E. C.	87.73	59.7	74.61	50.8
C. B.	88.00	59.9	77.59	52.8
C. K.	91.64	62.4	73.20	49.8
V. L.	91.14	64.1	76.68	52.2
Average	89.75	61.2	74.97	51.0

TABLE 3

The surface tension of the urine of normal men taking sodium bicarbonate in doses sufficient to maintain alkalinity

Based on 30 determinations

SUBJECT	NORMAL <°t	NORMAL SURFACE TENSION	SODA <°t	SODA SURFACE TENSION
		dynes		*dynes*
E. C.	87.73	59.7	94.30	64.2
C. B.	88.00	59.9	100.30	68.1
C. K.	91.64	62.4	97.50	66.5
Average	89.12	60.7	97.37	66.4

Why, then, should the administration of sodium bicarbonate in doses sufficient to maintain an alkaline reaction in the urine completely rob that fluid of its bactericidal properties?

The explanation is as simple as it is brief.

The surface tension of normal urine (table 1) is in the neighborhood of 60 dynes per centimeter.

The surface tension of the urine of normal men receiving therapeutic doses (0.6 gram three times daily) of hexylresorcinol is in the neighborhood of 50 dynes per centimeter (table 2).

The surface tension of the urine of normal men receiving doses of sodium bicarbonate sufficient to maintain alkalinity, is in the neighborhood of 66 dynes per centimeter (table 3).

There is evidence to show that other things being equal, the lower the surface tension of a solution, the greater the effectiveness of a given dilution of the disinfectant it contains.

The administration of sodium bicarbonate robs the urine of its bactericidal properties not because it creates an alkaline reaction but because *it raises the surface tension of the urine* to a point which renders the concentration of the hexylresorcinol it contains completely ineffective.

The surface tension of pure water is 77 dynes per centimeter whereas the surface tension of normal human urine is in the neighborhood of 60 dynes per centimeter.

It is apparent therefore, that the normal constituents of human urine depress surface tension and that the lower their concentration, the higher will be the surface tension. In other words, we would expect that the dilute, almost colorless, urine of low specific gravity which follows the ingestion of large quantities of water would show a high surface tension. Such, in fact, is the case. It is a simple matter to raise the surface tension of the urine secreted by a normal man from the normal level of about 60 to 75 dynes and above. A single example will suffice to show this although all subjects do not respond in the decisive manner shown in this instance.

Subject E. C. April 3, 1925.

9 a.m., specimen, control urine—51.7 dynes per centimeter (given 500 cc. water).

11 a.m., specimen, surface tension—63.4 dynes per centimeter.

12 m., specimen, surface tension—64.7 dynes per centimeter. (given 500 cc. water).

1 p.m., specimen, surface tension—75.0 dynes per centimeter (urine water clear).

2:40 p.m., specimen, surface tension—68.7 dynes per centimeter.

The beneficial effect of forcing fluids and the administration of large, repeated doses of sodium bicarbonate as commonly practiced in the treatment of the *acute* pyelitis of pregnancy and in the *acute* pyelitis of infancy cannot be denied. The benefit thus obtained may be explained by the mechanical effects (lavage) of the diuresis which results. This procedure has stood the test of time and is entirely logical in the treatment of acute infections of the urinary tract, which like most acute infections incline to spontaneous subsidence if given a chance. Unfortunately, chronic infections of the urinary tract do not respond to this treatment. Bladder irrigations, renal lavage, and the administration of internal urinary antiseptics are now generally believed to be essential to the proper treatment of these chronic infections when all discoverable causes have been removed. Yet, remembering the happy results obtained in the *acute* infections by forcing water and prescribing large repeated doses of soda, these measures are both frequently added to the active antiseptic therapy. In fact, it may be said that it is almost an invariable routine to instruct the patient with a chronic infection of the urinary tract and who is receiving bladder irrigations or renal lavage with some one of the many germicides commonly employed for this purpose, *to drink quantities of water.* The same instructions are usually given to the patient who is receiving an internal urinary antiseptic.

Such a procedure is entirely illogical in view of the facts reported above. Not only does the dilution of the urine which results from forcing water reduce the concentration of the antiseptic or germicide employed, but also raises the surface tension of the urine, thereby, still further depressing its effectiveness.

CONCLUSIONS

1. Surface tension is an important factor in disinfection by chemical means for the following reasons:

a. Germicides which themselves lower the surface tension of their solvents probably owe part of their bactericidal power to this fact, for the reason that the rate of diffusion of the solution through the cell membrane of the organism is increased.

b. The lower the surface tension of a germicidal solution the greater will be its ability to "seep" into the microscopic crevices and spaces of mucous surfaces—in short—the greater will be its "penetrability."

2. Hexylresorcinol is a powerful surface tension reducent.

3. Hexylresorcinol by mouth, in therapeutic doses, results in a pronounced reduction in the surface tension of the urine.

4. Sodium bicarbonate by mouth results in a pronounced rise in the surface tension of the urine and due to this fact the urine of a patient taking hexylresorcinol is robbed of its bactericidal properties.

5. The ingestion of large quantities of water results in a pronounced rise in the surface tension of the urine and defeats the object of both local and internal antiseptic treatment of urinary tract infections by:

a. Reducing the concentration of the drug in the urine, and by

b. Reducing the normal effectiveness of even that concentration by raising the surface tension.

6. By raising the surface tension of the urine the administration of sodium bicarbonate defeats the object of both the local and internal antiseptic treatment of chronic infections of the urinary tract and should be contraindicated in all such cases except those in which the employment of a drug which is ineffective in acid urine seems advisable.

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NECROPSIES ON FIVE CASES OF SEPSIS TREATED WITH MERCUROCHROME

A. V. ST. GEORGE

From the Pathological Laboratories of Bellevue Hospital, Dr. Douglas Symmers, Director, and the Office of the Chief Medical Examiner of the City of New York, Dr. Charles Norris, Chief Medical Examiner, New York

In our constant search for ideal therapeutic remedies, every new drug or chemical is hailed by its discoverer and other enthusiasts as representing the therapeutic millenium. We now appreciate the limitations, untoward and even dangerous effects of Salvarsan; nevertheless a decade ago it was hailed as the curer of syphilis. In the past few years an antiseptic—mercurochrome—has been placed on the market and considerable literature extolling its virtues has accumulated. Only two or three meagre reports have come to the writer's attention in which some unfavorable symptoms followed the intravenous administration of this preparation and advising more caution and control in its application.

During the past year the following five cases, in which mercurochrome was administered intravenously, came to autopsy in the Chief Medical Examiner's Department of the City of New York, and showed, amongst their anatomico-pathologic changes, lesions which are generally considered as indicative of mercuric chloride poisoning.

Case 1. A. S. (2694), white, aged thirty-six years, married, was admitted to the hospital March 31, 1924, with a history of having had her womb opened to induce abortion, and of taking a large amount of various abortifacients. The chief symptoms, on admission, were pain in the lower abdomen, vaginal bleeding, nausea and fever; the temperature on admission was 102°F.; pulse 96; white blood cells 14,800; polymorphonuclears 87 per cent. On April 3, the blood culture was positive for streptococcus hemolyticus (2 colonies per cubic centimeter). Gentian violet was administered without beneficial effect. Blood cultures

were positive for streptococcus hemolyticus on April 13, 19, 24 and 28, there being 6, 10, 14 and 20 colonies per cubic centimeter, respectively. On April 25, 35 cc. of a 1 per cent solution of mercurochrome were administered; similar quantities were given on May 9 and May 11. On May 12, 20 cc. were administered, and again on May 14, 35 cc. were given. No change was apparent following the administration of mercurochrome, either in temperature or in the course of the illness, save for discoloration of the skin. The urine at various times contained albumin, pus and red blood cells. Death occurred on May 15.

Abstract of post-mortem record. The body was that of a middle aged white female, 5 feet ½ inch in height, well formed, well nourished, rather obese; panniculus 1½ inches; large flabby breast; pale areolae; thick secretion on expression. No marks or bruises were present on the body, except for discoloration on the inner side of the left knee and over the dorsum of the left hand. The left conjunctiva was injected, the iris blue. On section, the peritoneal cavity contained about 50 cc. of dark straw-colored fluid. The left pleural cavity was about one-third filled with free, bloody, sero-fibrinous fluid.

Lungs. The left lung was collapsed, very poorly aerated, the bronchi congested. The right lung, as seen through the pleura, was blue; on section it was found to be poorly aerated and fleshy in the lower lobe. The pulmonary arteries were natural.

Heart. The pericardial cavity contained clear, slightly blood-stained fluid. The heart was small, the muscle very flabby. The valves, coronaries and aorta were normal throughout.

Liver. Extended well above the costal diaphragm and was somewhat pale brownish in color, glassy on section. The gall-bladder was small; dark, slightly cloudy fluid was present; the mucous membrane was natural.

Pancreas. Was normal in size and configuration.

Spleen. Weighed 490 grams. A cystic mass was present at the upper pole, filled with grumous fluid and lined by a yellowish zone (septic liquefying infarct). Otherwise the spleen showed no changes, save for a few smaller infarcts, about 1 cm. in diameter.

Adrenals. Were large and flat, with a dark bluish red medulla.

Kidneys. Were large and swollen. On section, the cortex was very pale and the medulla deeply injected. The capsule was free, the surface smooth, pale yellowish in color. Pelves, ureters and urinary bladder were normal.

Genitalia. Appeared fibrotic. The tubes were natural and there

was no recent corpus luteum present. The uterus was normal in size, measuring 2½ by 2 by 1 inch; the external os was large, bluish in color, somewhat ragged. The vagina was natural except for a roughened membrane.

Gastro-intestinal tract. The esophagus was natural. The mucosa of the stomach was pale. The duodenum was natural. There were extensive adhesions about the loops of the small gut opposite the lower right abdominal quadrant, where it was firmly attached to the wall. The mucous membrane of the small gut was everywhere natural in appearance, the upper portion being filled with yellowish bile-stained fluid. The caecum and ascending colon were enormously distended with gas, the mucosa showed elevated reddish rugae and, in places, a distinct granular appearance. A large amount of dark lemon-yellow feces was present. The mucous membrane of the transverse and descending portions showed areas which were grayish and granular in appearance, with superficial ulcerations. The same was true of the lower portion of the rectum, namely, that portion above the anal canal (suggestive of bichloride).

Anatomical diagnosis:

Sero-hemorrhagic pleuritis (left)
Collapse of left lung
Splenomegaly; infarction
Necrosis of spleen
Ulcerative and exudative colitis
Acute parenchymatous nephritis
Parenchymatous degeneration of viscera
Sepsis

Histological examination. The kidney showed degeneration of the renal parenchyma, with hemorrhage, fatty infiltration and calcium deposits in the descending tubules. The ulcers in the intestine showed necrosis of the surface epithelium, with round-cell infiltration at the margins and diffuse edema and hemorrhagic extravasation.

Case 2. M. A. (3283), a negress, twenty-six years of age, married, was admitted to the hospital on June 7, 1924. Following an abortion, performed three weeks prior to admission, the patient developed pain over the lower abdomen, chills and fever. On admission, her temperature was 102°F., pulse 104, respirations 24; the blood culture was sterile;

albumin and a few pus cells were found in the urine. On June 11, 20 cc. of a 1 per cent solution of mercurochrome were given intravenously, after which the patient developed severe diarrhea, lasting two days, and albumin, pus, casts and blood cells were present in the urine. On June 17, 20 cc. of a 1 per cent solution of mercurochrome were administered intravenously; immediately thereafter the patient developed severe chills, and shortly thereafter diarrhea, which persisted until death; the blood culture at this time was sterile. Death occurred on June 18.

Abstract of post-mortem record. The body was that of a black adult female, 5 feet $2\frac{3}{4}$ inches in height, weighing approximately 120 pounds. The breasts were firm, the nipples protruding, the areolae wrinkled and dark in color; on pressure, the breasts exuded milk. There were striae on the abdomen on either side. The vulval orifice was wide, admitting two fingers easily; the hymen was represented by a few smooth, flat tabs; there was a watery discharge from the vagina. On section, the pelvic cavity showed a small amount of purulent material with a few flakes of fibrin, and the lower portion of the ileum showed discolorations and soft areas covered by fresh fibrin. The abdominal cavity contained a small amount of fluid which was slightly cloudy and tinged yellow. The diaphragm was at the level of the fourth rib on the right, the fifth rib on the left.

Lungs. Both lungs were free, pale; the cut surface showed hemorrhagic mottled areas, which were firm and granular.

Heart. Weighed 400 grams. There was marked hypertrophy of the left ventricular wall, which was nearly 2 cm. in thickness and, on section, the muscle was pale and mottled with a number of irregular yellowish areas. The valves were normal, the fossa ovalis closed. The coronaries showed no changes.

Liver. Weighed 2080 grams. Cut section showed small yellowish mottled areas, suggestive of focal necroses. The gall-bladder contained dark greenish, ropy bile, and the mucous membrane was normal.

Adrenals. Were large; the medulla showed small hemorrhagic areas.

Kidneys. The capsule stripped with some difficulty and the surface was studded with small hemorrhages. The kidney substance was mottled; the markings were very irregular, the pyramids slightly violaceous in color. Combined weight of kidneys—360 grams. Pelves and ureters showed no changes.

Genitalia: The uterus measured $3\frac{1}{2}$ by $2\frac{5}{8}$ by $1\frac{5}{8}$ inches. On section, the mucous membrane was covered with a blood clot and was injected; the sinuses were somewhat enlarged. There was no evident perfora-

tion. Both tubes were normal. The right ovary contained a small corpus luteum cyst; the left ovary showed several cysts; one, the size of a hazel-nut, was filled with watery fluid and one corpus luteum with a yellow zone about $\frac{1}{16}$ inch, a central pale zone about $\frac{1}{4}$ inch, the whole measuring about $\frac{2}{3}$ inch. The external os measured $\frac{1}{2}$ inch in diameter and 1 inch in circumference; the internal os measured $\frac{1}{2}$ inch in circumference.

Gastro-intestinal tract. The stomach was normal. The small intestine was normal as far down as the last half of the ileum, where there were injected areas. The last foot of the ileum showed distinct ulcers, covered with greenish slough, and the wall of the ileum was thickened. The upper portion of the large intestine showed petechial hemorrhages; the lower portion of the sigmoid likewise showed petechial hemorrhages. The rectum presented ulcers similar to those found in the ileum, namely, irregular, serpigenous shaped ulcers, covered by greenish slough. The mesenteric glands were hypertrophied.

Spleen. Weighed 220 grams. The capsule was tense, the cut surface firm and red in color.

Anatomical diagnosis:

Septic pelvic peritonitis, secondary to abortion
Ulcerative enteritis and colitis
Cardiac hypertrophy
Broncho-pneumonia
Acute diffuse nephritis
Sepsis

Histological examination. The kidney showed intense parenchymatous degeneration, with necrosis, round-cell infiltration, hemorrhage and edema. The intestine showed necrosis and degeneration of the surface epithelium, and replacement by edematous and necrotic slough. The deeper portions of the gut wall were edematous and showed dense collections of nuclear debris and, in places, hemorrhagic extravasation.

Case 3. M. M., admitted to the hospital on September 24, 1924, with a diagnosis of septic abortion (spontaneous) ten days before admission, followed by chills, fever and abdominal pain. On September 25, 20 cc. of a 1 per cent solution of mercurochrome were given intravenously at 8 p.m., followed by chill and rise of temperature to 104.6°F., with subsequent fall to 101.4°F.; four very loose stools were passed during the

night. On September 26, at 8 p.m., 1 cc. of typhosis serum was given intravenously for foreign protein, followed by chill; alcohol sponge given; temperature dropped to 99.6°F. within a few hours. Previous to September 27, the patient had been irrational and semi-comatose, but on that day, for the first time, she was conscious and talked intelligently. At 7 p.m. of the same day, there was sudden onset of coma, with frothing at the mouth; the left pupil was widely dilated, the right not markedly so, both pupils reacting to light; the knee jerks and elbow reflexes were equal and active. The patient died within one hour, without regaining consciousness. A blood culture taken on September 25, previous to the administration of mercurochrome, was sterile; another, taken on September 26, after mercurochrome therapy, was likewise sterile. On September 26, the stools showed the presence of blood. The urine contained pus and blood, but no casts.

Abstract of post-mortem record. The body was that of a white adult female, 4 feet 9¼ inches in length, weighing about 80 pounds. The breasts were large, the nipples protruding partially; areolae pale; on pressure, watery fluid exuded from the breasts. The vaginal orifice was wide, admitting 2 fingers easily; the hymen was represented by two irregular tabs. No free fluid was present in the peritoneal cavity. The diaphragm reached the fourth rib on the right, the fourth space on the left. The omentum was thin and membranous. A small amount of of straw-colored fluid was present in the left pleural cavity. The thymus was small and somewhat fleshy.

Heart. The pericardial cavity contained yellowish cloudy fluid. The parietal and visceral layers of the pericardium were rough and covered with a shaggy exudate. The right cavity of the heart contained clotted and fluid blood; the valves on this side were normal. The left cavity also contained clotted and fluid blood and, on the aortic valve, was a fresh vegetation, friable, soft. The heart muscle showed the presence of yellowish areas; fossa ovalis was closed. The coronaries were normal.

Lungs. The left lung was heavy; on section, an old tuberculous scar was found at the apex; a portion of the lung showed congestion. The right lung was somewhat edematous. The bronchi were normal.

Liver. On section, the liver was brownish yellow in color and showed an increase in fat and possible focal necroses.

Spleen. The spleen was large, the capsule mottled and slate colored, with white areas and punctate hemorrhages. The cut surface was very soft and mottled with pink areas on a red back-ground.

Kidneys. Were large; the capsule stripped with some difficulty; the cortex was wide, pale and the pyramids violaceous in hue. Pelves and ureters were stained a yellowish hue; otherwise normal. The bladder contained about 5 ounces of urine, yellowish in color; the mucous membrane was normal.

Genitalia. The uterus measured 3½ by 2½ by 1½ inches; the external os measured 1½ inches in circumference, the internal os 1 inch. There were no tenaculum marks evident. There was a small, pea-sized fibroid present in the anterior wall of the uterus. The mucous membrane of the uterus was covered by blood-stained mucus. The sinuses were dilated. The tubes were normal. The left ovary showed a corpus luteum which measured ⅝ inch.

Gastro-intestinal tract. The stomach contained brownish fluid; the mucous membrane being normal. The small intestine contained the usual chyme. Watery, blood-stained fluid was present in the large intestine, the mucous membrane being markedly injected in some places, other portions showing raised, greenish gray ulcerations and marked thickening of the bowel, the whole being stained reddish.

Head. The scalp, calvarium and meninges were normal. The left hemisphere was much softer than the right and the markings between the gray and white matter were not as sharp as on the right side. Careful search revealed a formed embolus in the middle cerebral artery on the left side, just above the bifurcation of the carotid and anterior to the middle third. The base of the skull was normal.

Anatomical diagnosis:

Embolus, left middle cerebral artery
Acute septic valvulitis, involving aortic valve
Anemic infarct of heart muscle
Anemic infarct of left kidney
Septic spleen
Parenchymatous degeneration of heart muscle, liver and kidney
Ulcerative colitis
Septic endometritis
Corpus luteum, left ovary
Acute pericarditis
Pyo-pericardium
Mercurochrome staining of viscera
Sepsis

Histological examination. The kidneys showed a diffuse parenchymatous degeneration, with fat deposition and extensive calcium degeneration of the descending tubules. The colon showed superficial ulcerations with epithelial necroses and an edematous slough. The remainder of the wall showed intense edema, hemorrhagic extravasations and granular debris.

Case 4. T. P., admitted to the hospital November 1, 1924, in delirium, with infected right hand, spasticities, temperature 103.2°F., pulse 96, respirations 26. The urine contained albumin, a few hyaline casts, but no pus or blood cells. The hand infection was treated by incisions and drainage; culture of the wound showed the presence of streptococci. On November 4, blood culture was positive for streptococcus, and on the same day 20 cc. of a 1 per cent solution of mercurochrome were given intravenously, followed by severe chill and rise of temperature to 105°F. On the following day, the temperature dropped to 100°F. and diarrhea developed, lasting two days. On November 7, the spinal fluid showed the presence of streptococci and blood culture was positive for streptococcus communis. On November 9, 20 cc. of a 1 per cent solution of mercurochrome were administered intravenously, followed in 1½ hours by a severe chill and elevation of temperature to 105°F. On the following morning, the temperature receded to 101.2°F. and severe diarrhea developed, which persisted until death. The patient's general condition showed no improvement. She presented quite marked puffiness of the eyelids and the urine gave a marked reaction for albumin, many hyaline and granular casts, and numerous pus and blood cells. On November 15, 20 cc. of a 1 per cent solution of mercurochrome were given intravenously, the reaction on this occasion being less marked than on November 9. On November 17, the blood culture was positive for streptococci (20 to 30 colonies per cubic centimeter of blood). Death occurred on November 19.

Abstract of post-mortem record. The body was that of a white male, 5 feet 3 inches in height, weighing 118 pounds. Externally there were no injuries, except for two operative incisions on the dorsum of the right hand. The deep tissues were necrosed and the muscle was deep red and infiltrated with pus; no thrombosis was noted in the surrounding vessels.

Lungs. The right pleural cavity contained purulent fluid and the right lung was covered with fresh fibrin over the base, and was injected. The cut surface was congested. The left lung was free and the cut surface was normal, except for three or four small abscesses on the surface.

Heart. The pericardial sac was distended by purulent fluid, and both the parietal and visceral layers of the pericardium showed a shaggy membrane. The valves were normal. The musculature was normal, except for a small abscess cavity in the fat of the apex, not involving the muscle. The fossa ovalis was closed.

Adrenals. Were large, the medullae injected.

Kidneys. Were large and swollen, the markings somewhat obscured. The cortex was pale yellowish pink in color, and the pyramids were deep purplish red in color. Pelves were injected.

Gastro-intestinal tract. The esophagus was normal. The stomach contained yellowish fluid; the mucous membrane was normal. The small intestine contained the usual chyme; the mucous membrane was normal. The large intestine contained fluid greenish material; the mucous membrane from the ileo-cecal valve through to the rectum showed superficial ulceration and necrosis, resembling mercuric enteritis.

Head. The brain showed a purulent exudate covering both hemispheres, most marked on the left side and extending into the medulla and spinal cord. Smear of the pus showed many streptococci.

Anatomical diagnosis:

Acute suppurative pericarditis
Acute suppurative pleurisy (right)
Acute suppurative meningitis
Abscess of lung and epicardium
Cellulitis of right hand
Acute ulcerative colitis
Acute nephritis

Histological examination. The kidney showed intense parenchymatous degeneration, marked injection of the vessels, fatty infiltration of the cells and some calcium degeneration. The colon showed erosions of the epithelium, localized ulceration and oedema and degeneration of the sub-mucosa and muscularis, with extensive nuclear debris.

Case 5. B. G., white, female, aged thirty-six, admitted to the hospital November 17, 1924, with the diagnosis of septic abortion, resulting from the self-introduction of an orange-wood stick six days prior to admission. During her stay in the hospital, the temperature ranged from 104 to 105°F., the pulse from 105 to 130, and the respirations from

26 to 48. The white blood cells numbered 15,600, polymorphonuclears 88 per cent. The urine contained albumin, an occasional cast and pus cells. On November 18, blood culture was positive for streptococcus hemolyticus and staphylococcus aureus. On November 19, 20 cc. of a ½ per cent solution of mercurochrome were given, and on the following day a similar amount was administered. Blood culture taken after the latter injection was still positive, and the urine contained albumin, pus, many casts and red blood cells. The patient died on November 21st.

Abstract of post-mortem record. The body was that of a female white adult, 5 feet in height, weighing about 160 pounds. Puncture wounds were noted in the left and right cubical fossae, under the breasts. The vaginal orifice was wide, admitting three fingers with ease; a brownish discharge escaped from it. Milk could be expressed from the breasts. On section, no free fluid was present in the peritoneal cavity; the diaphragm reached the fourth rib on both sides.

Lungs. Both lungs were free, the cut surfaces showing congestion; the bronchi and vessels appeared normal.

Heart. Weight about 400 grams. The pericardium showed a number of petechial hemorrhages. The mitral valve was thickened from an old mitral valvulitis and, in addition, showed fresh vegetations; the rest of the valves were normal; fossa ovalis was closed.

Liver. Was normal in size and form; the cut surface was normal except for parenchymatous changes. The gall-bladder was normal.

Spleen. Was large, weighing 300 grams. On section, it showed a large infarct, with softening in the centre of the infarct; the cut surface was uniformly red.

Kidneys. Were large. The capsule stripped with some difficulty. The surface was studded with small abscesses, surrounded by hemorrhagic zones. On section, the cortex was pale yellowish, with deeply injected medulla; pelves and ureters were normal.

Genitalia. The uterus measured 4 × 3 × 2½ inches; external os measured ¼ inch in diameter and ¾ inch in circumference; internal os measured 1¼ inches in circumference. There were two grayish punctate marks on the anterior lips of the cervix, probably tenaculum marks. The tissue of the internal os was greenish and necrotic. In the cavity of the uterus was a placental site on the superior wall, covered by a fresh, green, necrotic slough. The walls of the uterus were thick and the sinuses dilated. The left ovary showed a large corpus luteum cyst, measuring 1 inch in diameter, filled with clear fluid and surrounded by a lutein zone, 1⅛ inch in diameter. The tubes were normal.

Gastro-intestinal tract. The stomach contained brownish fluid; its mucous membrane was normal. The small intestine contained the usual chyme and feces; the mucous membrane was normal throughout, except for punctate hemorrhages here and there. The caecum was intensely injected, hemorrhagic and stained yellowish red in color. The lower colon showed a half dozen superficial ulcerations.

Anatomical diagnosis:

Acute and chronic mitral valvulitis
Infarcts of spleen
Septic endometritis
Abortion
Acute colitis
Acute nephritis
Miliary abscesses of kidneys

Histological examination. There was a slough over the erosions in the colon, oedema, some polynuclear and round-cell infiltration, and hemorrhage. The kidneys showed parenchymatous and fatty degeneration, focal abscesses and marked congestion.

DISCUSSION

The above five cases represent the first of a series which came under observation in the Chief Medical Examiner's Office. Since these cases all showed strikingly similar lesions, both in the kidneys and in the colon, the Chief Medical Examiner has performed post-mortem examinations on all cases reported to his department in which mercurochrome has been used, with the result that he has accumulated a series of 12 cases, all of which showed evidence of renal and colon involvement.

In the five cases presented herewith, it is our opinion that mercurochrome induced the intense nephritic and intestinal lesions and thus contributed to death. Chemical analysis of all the viscera in these cases, made by A. O. Gettler,[1] Pathological Chemist to Bellevue Hospital and Toxicologist to the Chief Medical Examiner of the City of New York, showed mercury in even larger amounts than is found in mercuric chloride poison-

[1] To be published.

ings, which fact indicates the marked toxicity of this drug and justifies the above statement.

It may be argued that cases have been reported where the drug was used successfully, although a temporary nephritis and colitis did accompany its use, and hence the lesions could not be of moment. To this, it may be answered that mercuric chloride poisonings with non-secreting kidneys and severe colitis do recover and the kidney and colon are apparently restored to normal, though subsequently these patients show a chronic nephritis, a factor which has not as yet been determined in mercurochrome cases.

From the meagre cautioning literature and the unfavorable cases that are everywhere discussed but not published, it is evident that the dangers of the drug have not been brought sufficiently to the fore. Locally, mercurochrome probably is a very good antiseptic, systemically it may possibly be of value in selected cases when properly administered and controlled, though its indiscriminate use, for example, in such conditions as acute rheumatic fever or malaria should not be tolerated. That its dangers are constantly to be borne in mind is apparent from the above case reports, in that mercurochrome in its therapeutic dose not alone exhibited no curative effect, but produced lesions associated with a toxicological agent, and the margin of safety between a therapeutic and a toxic dose must be very variable and small indeed.

DISCUSSION

Dr. GEORGE G. SMITH (Boston): I would like to ask Dr. Leonard if it is indicated to give some other antiseptic at the same time with hexylresorcinol. Is there any contraindication to giving hexamethylenamin.

Dr. GEORGE R. LIVERMORE (Memphis): I do not like to let this pass unnoticed. There seems to be a divergence of opinion here with regard to Dr. Young's wonderful report and Dr. Braasch's wonderful report and then the autopsy findings in the cases reported from New York. We have used it considerably at home, in Memphis. Dr. Allen, who is in charge of Veterans Hospital No. 88, has used it almost indiscriminately in all types of cases, and his results have been most favorable.

In our own series of cases, we have seen some rather striking results and some very unfortunate results. We have had one near death in a patient who had a very violent chill, with a temperature of 106½°, absolutely unconscious, absolutely no radial pulse for over four hours, but she did not die. She had a pyelonephritis, with rigors, high fever, and sweats of about five days' duration. This was cleared up but the kidney infection was not influenced.

In a case of typhoid fever treated with an internist in which the patient had a pyelonephritis with staphs and colon bacilli in the urine, the most astounding results were obtained with three injections and a complete sterilization of the urine. I have not seen any cases of colon or staphylococcus infections of the kidney that have been cleared up.

In another case, given by another physician, complete anuria was produced for forty-eight hours, but the patient began secreting urine at the end of forty-eight hours and came out of it all right.

There is a physician who has his office next to mine, Dr.

Pistole, who has given this to patients in his office in from 25 to 35 cc. of a 1 per cent solution, and has allowed his patients to go home in taxicabs. To my knowledge, he has given this about a hundred times and he has not had any fatalities.

It certainly is remarkable to me that there is such a divergence of opinion on this question.

Dr. J. A. C. COLSTON (Baltimore): I was very much surprised to hear, and very greatly interested in Dr. St. George's results because I must say we cannot explain them at all. We have certainly given well over 150 injections; the majority of them are 3, 4 and 5 mgm. per kilo. We have never had a patient dangerously ill. They do get very sick, some of them, with considerable nausea and vomiting and considerable diarrhea. The only way I can possibly explain it would be by some special effect of the particular organism which is active in these cases of abortion.

We have never noted, as I say, any diarrhea which persisted; bloody diarrhea occurs in a small proportion of the cases, but invariably clears up in a short time.

Miss Hill and Dr. Bidgood carried out a series of experiments on animals, and they found that they could give two injections per week, 5 mgm., per kilo, for a series of twelve injections, and those animals showed at autopsy (none of them died) cloudy swelling of the kidney, and that was all. Injections above that, up to 7.5 mgm. per kilo, showed more intense lesions, and 10 mgm. per kilo was sometimes fatal and sometimes not.

In regard to the effect of mercurochrome in general infections, we have noted that the temperature reaction, as shown by Drs. Young and Braasch, will give one an excellent idea as to what is going to happen. That is, in those cases in which there is no reaction, there is usually no therapeutic effect. Cases that show splendid results will almost always show that sharp rise of temperature to 104° or 105° with a chill, and then a rapid fall.

In a case of septicemia caused by the staphylococcus hemolyticus which I treated about a month ago, 4 mgm. per kilo was given; there was no effect at all upon the temperature. So within about three hours after the injection I could almost safely say

that there was going to be no therapeutic effect—and that was true. The infection continued its course with a fatal result in spite of the intravenous treatment.

Dr. JAMES A. GARDNER (Buffalo): My attention was first called to hexylresorcinol in January. Since then I have used it with satisfaction in cases of colon and staphylococci infection. Careful instruction has always been given to patients to take the capsules during the meal time.

One patient with a chronic colon pyelitis who has been under my care periodically for some years made a remarkable recovery. When I congratulated her upon her urine being colon free, she stated that she could not swallow the capsules, so she cut them in half and took them between meals.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): May I say a few words in regards to our experience with hexylresorcinol?

Dr. Leonard states, I believe in one of his early articles, that hexylresorcinol is not a renal antiseptic, that it is a urinary antiseptic; furthermore, that it is most efficacious with coccal infections; in other words, it is applicable particularly where there are infections of the mucosa involving the pelvis, ureter and bladder, and where a coccal infection is present.

The types of urinary infection that we see, unfortunately, are made up of only a small proportion of that particular group. In other words, the cases we observe either have acute or subacute renal infections or that type of chronic renal infection known as chronic bilateral pyelonephritis with B. coli infection. Therefore, the field is certainly very limited where it can be of any value, according to the admissions of the discoverer himself. It is true that in some cases with colon bacillus infections, as he states, it is followed by great relief.

Dr. Leonard was good enough to give several members of our staff a supply of this drug, and our experience has not been, I am sorry to say, very satisfactory. In the first place, we had only a limited number of cases where it was directly applicable as he describes. In that number of cases we have found some three

or four where there was a marked reduction in symptoms, and where there was also a marked reduction in pus, but where there was not a complete eradication of the infection. We have tried it in a number of cases of chronic pyelonephritis and we have failed to see any definite benefit in any way. It has also been tried out in fields other than my own, with comparatively similar results.

I hesitate to criticize either hexylresorcinol or mercurochrome, because Drs. Leonard and Young both deserve the greatest credit for their effort to discover a medium for antisepsis. They should have every encouragement and ought to be commended in every way because their work is epoch-making and is the result of much study and effort on their part. But after all is said and done, the proof of the pudding is not in the eating, but in the digestion, and my results with hexylresorcinol have not been very satisfactory.

Dr. WILLIAM E. LOWER (Cleveland): I want to discuss Dr. Boyd's paper briefly and to speak of the advantages of blood transfusion, not only in genito-urinary surgery but in surgery in general. We make it a routine procedure in all of our major operations to have the patient's blood grouped before operation and to group the members of the patient's family to be sure that we have a suitable donor. If no donor is available in the family there are many professional donors now available who can be used. This is an anticipatory measure for if we wait until something happens and the need for a blood transfusion becomes urgent it is often too late. If the indication for transfusion becomes apparent the house staff should have orders to proceed with it without any delay, just as they would give such medical treatment as might be indicated.

Dr. HUGH H. YOUNG (Baltimore): I would like to discuss Dr. St. George's paper for a moment.

Seeing that he was down for 5 autopsy cases, I had one of my associates look over the cases that had come to autopsy at the Johns Hopkins Hospital and in which mercurochrome had been administered. We have 5 such cases.

I am glad to be able to report to you, Dr. St. George, that Dr. Rich, Dr. McCallum's associate in pathology, has given me a statement, which I could read to you, bringing out the fact that there was absolutely no evidence whatever of injury to the kidney or the intestine as the result of using mercurochrome in these 5 cases. He tells us that in cases of chronic infection, especially of septicemia, changes in the kidney are to be expected, and also ulcerations in the intestine, and that they are not to be taken as conclusive evidence of injury due to drugs that may have been administered. We have frankly stated that after large and repeated doses a small amount of albumen and casts may be present, but that this has always disappeared in a few days.

If I remember correctly (having made notes quickly as you went on) in 4 of your 5 cases pus, albumen and casts were present before mercurochrome was given. Certainly if they were present before it was given, that would indicate that the nephritis, which the patient was found to have after death, was present before the mercurochrome was given. It seems to me very extraordinary for you to draw the deduction, sir, from this meager series of 5 cases in which nephritis was evidently present beforehand, that this drug is harmful and dangerous. From a study of some 60 cases in my clinic, with frequent urinalyses, phthalein tests and blood ureas, I feel absolutely confident that in none of our cases has intravenous injection of mercurochrome done any serious harm whatever. Our previous animal experiments have shown that, in therapeutic doses, it is harmless. These facts have been given in detail in my paper, and more fully in other papers, which have been covered, in extenso, in our paper in the May issue of Archives of Surgery.

I wish to assert, sir, that your deductions are thoroughly unwarranted and that if sent broadcast will probably cause the death of patients who would be saved, but who will probably be denied this one chance as a result of your assertions.

The criticism I would make of your cases, as reported by you, sir, is that you did not give them enough treatment. You mentioned, I believe, one patient who only received 20 cc., which is about 3 mgm. per kilo. He died a few days afterwards, and you

attributed that death to that one small injection. But we know that such a dose is perfectly harmless. It is ridiculous to attribute the nephritis that that patient had to the injection of mercurochrome, when the patient had albumen and casts beforehand.

I hate for you, with your associations and backing, to publish a paper of this sort, and to have it advertised to the profession that this drug is harmful in the way that you have said, when we know from a very long series of about 300 cases, sir, that it is not harmful. As a matter of fact, cases with albumen, casts and bacteria in the urine have cleared up completely after intravenous mercurochrome. Our animal experimentation and our autopsies, and our hundreds of clinical cases do not bear out your assertions in the slightest degree.

Dr. HENRY L. SANFORD (Cleveland): I fully agree with what Drs. Boyd and Lower have said. We do the same thing in our service in Cleveland. We have done one other thing in a group of cases of anuria.

We had the idea that perhaps the kidney was unable to secrete toxic substances, and if we could get rid of those substances from the system temporarily by venesection, preceding the transfusion, we perhaps might start the thing going again.

We have now had a series of such cases, too small to draw many conclusions from, but we have had a series of four cases now in which we did venesection followed by transfusion, and we got the patients to start secreting urine. I believe that is a thing that is worthwhile trying. That succeeded after decapsulation and all the other methods had absolutely failed.

One case, a boy of eight, had been anuric for five days. We decapsulated him, without any apparent effect for three days, and then twenty-four hours after the first transfusion he began to secrete urine.

PRESIDENT CHUTE: Would you mind stating why they were anuric?

Dr. SANFORD: Two of them were children, one a boy of eight and one a girl of about twelve, who had acute nephritis. Two were cases of bichloride poisoning. Both of those cases died later on, but we felt that we did turn the scale by that measure. They began secreting urine.

Dr. HARRY CULVER (Chicago): I would like to say that we have had some 50 cases at the County Hospital which we have treated with mercurochrome, all being surgical cases.

We have used the dosage advised by Dr. Young, and we have gone further and used as high as 8 mgm. per kilo, of body weight. We use as a minimum dose 30 cc. of 1 per cent. We have used as much as 50 cc. of 1 per cent. A reaction, as Dr. Colston emphasized, is necessary to secure a satisfactory result.

It has had a most gratifying effect on these cases of pyelonephritis, and a wonderful ocular effect on the sloughing wounds of acute urinary extravasation, and suprapubic sloughing wounds in prostatectomy.

One case of spontaneous gangrene of the scrotum immediately demarcated and made an uneventful recovery with sloughing of tissue.

We have followed the kidney function very closely and have noted a transitory albuminuria in many cases. We have not had a fatality and have not had anything to warrant the discontinuation of this drug.

Dr. JOSEPH HUME (New Orleans): I just feel that every one ought to mention their experience.

I have given a large number of doses of mercurochrome and agree with Dr. Young that I have never seen anything that was dangerous in connection with its use. I have seen patients exceedingly uncomfortable for one or two days, but I have not as yet had a case in which I was seriously worried about the condition.

It seems to me, however, that the results to be secured from the use of mercurochrome should be considered very seriously, and that we should employ closer methods of analysis in determin-

ing what cases are best suited for it, and what cases are not suited for it. In the chronic cases, I have had absolutely no results whatever, in the chronic pyelitis, and pyelonephritis. It seems to me that in those acute cases we ought to know whether they are cases in which there is a positive blood culture and cases which bear a focus of infection, which is not drained and which continually re-feeds the blood-stream.

I believe there are probably many cases in which we get a single invasion of the blood-stream. Give them a dose of mercurochrome and see what startling results you will get. I believe, however, where you have a focus of infection which is re-feeding the blood-stream all the time and which is not drained by surgical means, that those cases are probably the cases in which one gets the failures.

With regard to the hexylresorcinol, since it was put on the market, I have had about 40 cases on it, and I am extremely sorry to say that so far I have seen no results whatsoever and I do not understand why Dr. Leonard says that staphylococcal infections are easier to cure than colonic, because I think nearly all of us have found that staphylcoccic infections are more difficult to cure than colonic infections. I would like to know if he has any special method of administration other than he has stated, or anything to explain in that connection.

Dr. JOHN R. CAULK (St. Louis): I just wish to register myself with reference to hexylresorcinol.

Since last year when Dr. Leonard proposed this method of therapy, I have used it following his suggestions and like Drs. Braasch and Hume, I must say that in about 40 cases I have not seen the slightest benefit to the patient, and I have not seen the slightest change in bacterial cultures in a single case from the use of hexylresorcinol, even though I have given it in doses of 500 in three weeks. In the case of one man I gave it to him four times a day for three weeks, without the slightest change in a staphylococcic urine.

Of course, in ordinary conditions, we do not need it, but in the cases that are chronic, as Dr. Braasch says, we try everything,

and do not get very far. I have not seen the slightest benefit from the use of this drug.

PRESIDENT CHUTE: I am going to ask Miss Justina Hill, who has done so much work with Dr. Young, if she will speak to us on this subject.

MISS JUSTINA HILL (Baltimore): What Dr. Braasch said interested me profoundly, because we have reached exactly the same conclusions: that whereas we know mercurochrome is an excellent local germicide (that is, when it reaches the organism there is no doubt but what it kills it in the concentration in which it is used) we also showed before the drug was given intravenously that its action was very much cut down in the presence of serum, so that we now think that perhaps that is not a direct germicidal action entirely, but some effect upon the sytem and upon the patient himself. Whether it is a stimulus of the cells, or whether it has something to do with the enzyme action, I do not know.

I do notice that the temperature curves show they are very much like the foreign protein injections, and yet I think there are some differences, and I think this is a problem which will have to be approached now, and in that we may perhaps some day find a clue to the action.

I doubt if there is direct germicidal action. There may easily be bacteriostatic action, having some effect upon the organisms which weakens them so that the body itself can take care of them.

That is where at present we are, and that is the way to go at it, and I think Dr. Braasch has expressed the method of approach which must be used.

Dr. EDWARD L. KEYES (New York): Since the therapeutic value of hexylresorcinol has been attacked I wish to state that though I cannot estimate its precise value, yet it has given me some results that I have not obtained by any other means.

One patient after an acute pyelonephritis on her right side had pus and hemolytic streptococci in the urine, and after a few weeks' interval was alarmed by a return of bladder irritation

such as had preceded the acute kidney infection. She was given hexylresorcinol and immediately her bladder symptoms disappeared. After taking about 150 of the capsules in the advised dose of four after each meal she had no more pus in the urine, and after taking 150 more, 300 in all, it was impossible to cultivate any hemolytic streptococci from the urine.

A second patient with bladder paralysis from spina bifida has for twenty years required suprapubic lithotomy about once in three years. The predominant organism in his urine is the proteus. For a number of years past, and in spite of every treatment his urine has been utterly foul and stinking.

I started him on hexylresorcinol preparatory to another cystotomy for a couple of large stones in his bladder. He called me up on the telephone forty-eight hours later and said, "My wife says I am fit for publication for the first time in twenty years," and a week after operation the gross pus had almost disappeared from the urine.

Moreover, hexylresorcinol immediately kills the Thompson bacillus, our great bane after cystotomy.

Let me furthermore pay my tribute to Dr. Leonard for his study of surface tension. He has introduced an entirely new idea in our minds as to the physical effect of hexylresorcinol, an entirely new method of destroying bacteria, for which we should be most profoundly thankful.

PRESIDENT CHUTE: If there is no further discussion, I will ask Dr. Young to close his paper.

Dr. HUGH H. YOUNG (closing): Dr. Boyd's contribution is of great importance. Not only are blood transfusions a life saver in urological surgery, but they are also most valuable in the treatment of infections. I could show you two or three slides of cases in which no result was obtained with intravenous germicides until we gave them a transfusion. Transfusion of blood, added to intravenous germicides, brought results that we could not possibly get before.

The question as to what happens after the injection of various

drugs is one that has bothered the immunologists for many years. Browning, for instance, discusses this whole question at length but offers no solution of the question. It is impossible to say just exactly what does happen when these various foreign bodies, chemicals and proteins, etc., are introduced into the blood stream.

We feel confident that it has not a total germicidal effect, but I am inclined to believe that it may have to a certain extent an immediate germicidal effect upon the germs that come in contact with the antiseptic immediately after it is introduced into the blood stream. When the dye gets widely diffused and well dissolved in the whole blood-stream I feel confident that the strength and germicidal value is so weak that you cannot expect a total germicidal effect. But you do get, I believe, a certain amount of germicidal effect, and that, in some way, induces a serum reaction and that you get a systemic, a cellular and serum reaction, accompanied generally by a chill, high fever and sudden drop to normal. The temperature reaction, which we have called the intravenous germicide reaction, is extremely pronounced and generally identical in all febrile cases. It is much more pronounced with mercurochrome than with gentian violet and hardly occurs at all with novarsenobenzol. I believe the efficacy of mercurochrome is due to the pronounced reaction it causes, but just what all the factors are which are concerned in it we cannot say.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): I was somewhat disappointed that we did not have more testimonials from the members of this Association in regard to the use of intravenous chemotherapy. There is no doubt but what it offers a great deal for the future. We as urologists have found that it is particularly applicable to urologic infections, and should use it more and should discover, if possible, some of the secrets that are still withheld.

There is no doubt whatever that it has a great future in store for it. I am under the impression that the drugs we are using today are terribly crude, and that some day we will have better drugs, from which there will be little or no reaction and which will

give better and greater results. Therefore, I certainly would urge one and all of you to try out mercurochrome which today is unquestionably the best drug we have at our disposal, and also encourage in any way possible the discovery of new and better drugs for this purpose.

Dr. MONTAGUE L. BOYD (Atlanta): A few days ago I was told that Dr. Crile of Cleveland had said several years ago that in years to come blood was going to be considered just as much a dose of medicine, or just as much of a treatment as a C.C. pill. I do not think there is any question about that being so.

The point I wished to particularly emphasize in my paper was the need of blood in patients who are not in a particularly serious condition, but whose resistance has been lowered by the loss of blood at operation or by the loss of blood before operation. Those are the conditions in which I am finding the greatest number of uses for blood transfusions.

Dr. VEADER LEONARD (closing): I would like to say, first of all, that whether mercurochrome will ultimately prove to substantiate the claims of those who introduced it or not, the investigations which led up to the development of this compound form a monument to the credit of the clinic from which they came. The investigations of Dr. Young and his associates in the field of internal urinary antisepsis (and mercurochrome, as I understand it, was an outgrowth of that investigation) were epoch-making. They were able, through arduous years of work, to enumerate the qualifications which any substance must possess to be successful in this field. These qualifications were enumerated long before any such substance was known. It has greatly facilitated the investigations of those who followed Dr. Young in work of this kind. Entirely without regard to the results which one man or the other may get with mercurochrome, the big thing is that it was obtained in such a way that very definite footprints are left which we can all follow to very great advantage.

To come back to the discussion of my paper; with regard to Dr. Smith's question as to whether the use of other germicides

or antiseptics with hexylresorcinol would be contraindicated, I would say that I do not know anything about that. I have not used other antiseptics either intravenously or by mouth in conjunction with hexylresorcinol treatment in the cases under my observation, for the reason that I have been particularly interested in determining, if possible, exactly what hexylresorcinol could accomplish by itself.

There are one or two indications, however, which have come to me by accident which indicate that the efficiency of other germicides, such as mercurochrome, urotropin, and silver nitrate, may be very much increased in conjunction with hexylresorcinol treatment.

I just mentioned to Dr. Gardner a case which occurred early in the work; a woman with a chronic urinary tract infection whom I treated for about six weeks with hexylresorcinol without any result whatever. She became disgusted and went back to her family physician who gave her two bladder irrigations with 1:500 silver nitrate with a complete cure.

I have never seen silver nitrate act as promptly in any other case. Therefore I think I am justified in assuming that hexylresorcinol may have in some way paved the way. It may have been through the development of a strain of organism which was more susceptible to the silver. Very likely, the same result might have been accomplished with mercurochrome.

Dr. Helmholtz of the Mayo Clinic has reported to me that in one case, a little girl with a chronic B. coli pyelitis, who had received hexylresorcinol for twenty-seven days without result, had received large doses of urotropin by mouth for four days with complete cure. Dr. Helmholtz asked me what I thought about it. Well, modesty did not forbid my saying that I believed hexylresorcinol paved the way, because I have never seen urotropin clear up a chronic B. coli infection of the urinary tract in children or in adults, in four days.

Dr. Gardner mentioned the fact that his patient opened the capsules and took the solution between meals. The only reason I advise that hexylresorcinol be given immediately after meals is because I have found that a number of the patients complain of

gastric distress when they take it on an empty stomach. I have found that a glass of rich milk. which cuts down the concentration, prevents this effect.

Dr. Braasch, I am sorry to say, has had rather disappointing results. I think, however, I know the reason. May I ask a question, Dr. Braasch? What is the average length of time your patients are under observation?

Dr. BRAASCH: I have given no patient less than one month, and others three months' treatment.

Dr. LEONARD: Dr. Braasch has answered my question, and my point seems to be gone. Chronic B. coli infections of the urinary tract, require very persistent treatments for a result; from sixty to ninety days. It was my thought when Dr. Braasch mentioned his results that possibly at the Mayo Clinic he would be dealing with a more or less transient clinical population, and that his patients possibly do not receive from sixty to ninety days' continuous treatment.

I had the pleasure about ten days ago of listening to a paper by Dr. Henline, from the New York Hospital, Dr. Oswald S. Lowsley's clinic, in which he reported the results in the first 50 cases treated with hexylresorcinol. These cases were all chronic cases and had been under observation for a period varying from about two weeks to three years.

Of the 50 cases, 46, or 92 per cent, were completely cured as proved by sterile urine cultures. But here is the point: Between 80 and 90 per cent of those 50 cases were chronic B. coli infections and the average number of days of treatment necessary before the first sterile urine culture was obtained was sixty-three and a fraction—sixty-three and a fractions days' continuous treatment on maximum doses of this drug before they got results.

The average of the staphylococcus cases was eighteen days. Personally, I have seen a chronic staphylococcic infection of the urinary tract clear up in forty-eight hours. But these are unusual. The average appears to be about three weeks.

Two of the doctors mentioned the fact that they had been able

to see no results in staphylococcic infections. This is very difficult for me to understand.

I have seen 1 case of a bilateral staphylococcic pyelitis and cystitis, with probably a prostatitis, in which the kidneys cleared up on hexylresorcinol but the bladder urine continued to show staphylococci. We supposed that in this case the urine was being constantly reinfected by staphylococci from the prostate.

However, I have never seen hexylresorcinol fail to clear up a staphylococcus infection of the pelvis of the kidney without any other treatment whatsoever.

Dr. A. F. St. George (closing): I merely want to say that these cases which I presented here were not treated by me. They were treated in various hospitals in the city of New York and being medico-legal cases came to autopsy in the Bellevue Morgue. Naturally, we see the end results there.

Undoubtedly, there are large numbers of cases where mercurochrome has been successfully employed. In these cases it was not, and it showed lesions which conformed so uniformly to those that we find in mercuric chlorid poisoning that Dr. Norris, the Chief Medical Examiner, was rather surprised and interested, and he has on the last 7 cases performed all the autopsies himself. I am sure we all agree that Dr. Charles Norris is an extremely careful, as well as experienced pathologist.

Granting that these patients had a nephritis before they received the mercurochrome, nevertheless when we autopsied these cases they showed an acute nephritis which in our experience looked very much more like a mercury kidney rather than the acute nephritis that may accompany septic conditions. The only kidney that is possibly comparable to it is a scarlet fever kidney.

Again, in sepsis we may find an acute nephritis, but we do not find the uniform degeneration of the tubules or at least not as extensively as we do in cases of mercury poisoning. And, last, it is extremely rare to find an ulcerative colitis in sepsis. It does occur, but it is very, very rare indeed.

Just as one of the gentlemen stated, it may be that the focus

of infection in most of our cases, being in the septic uterus, had not been eradicated and hence the administration of the drug was without avail. That is a point that we have not determined.

I dare say that everybody here would agree that salvarsan is a wonderful drug. Nevertheless, in the experience of the Bellevue Morgue, we annually have quite a number of cases that die showing lesions of arsenical poisoning. That does not mean that the drug may not be of value, but what I wanted to bring out particularly was that mercurochrome is not the sort of drug that can be used indiscriminately the way it is used in some hospitals, for example in cases of acute rheumatic fever, when every one knows the value of salicylates, for this condition, or as I am told in Panama, where they give it to cases of malaria, when quinine has always worked very efficiently for this infection.

SECOND DAY, MAY 5, 1925

THE NEED OF CONSERVATISM IN RENAL SURGERY

ARTHUR L. CHUTE

Boston

Received for publication June 15, 1925

Certain experiences, as well as observations, have led me to wonder whether the time has not come for us to begin a campaign for conservatism in renal surgery; whether in this field of surgery the pendulum has not swung too far toward the side of radical operation. I will admit that I have no conclusive evidence to offer but simply certain points that I believe have some suggestive value.

At first I wish to report briefly some personal cases in which I believe too radical a course was followed. Observation has led me to believe that my experience is not unique.

An instance that is particularly clear in my mind is that of a young woman whose left kidney I removed for a rather moderate degree of hydronephrosis and hydroureter five years ago. She had suffered from severe pain in her left loin and an attack or two of temperature. I have been unable to find in the hospital record the figures as to the functional value of the left kidney, but my recollection is that I took her kidney out because it was giving discomfort and because I felt that she had a good kidney on her other side. This patient returned a few weeks ago with a stone in her remain ng kidney. To my mind this represents an instance of renal surgery that was probably not truly conservative in that I removed a kidney which although it was giving trouble, still had some considerable value. It is fair, I believe, to assume that the extra work thrown on the right kidney predisposed it to stone formation. As the stone in this instance was the size of a

small white bean, was in the lower calyx, and was accompanied by an infection, I fear this patient has a process started which is going to be steadily progressive.

Two somewhat similar instances have come to my notice within the last few years where a nephrectomy had been done a few years before and in which at the time I saw these patients there was a hydronephrosis on the remaining side; the presumption is that it was there at the time of operation. One of these patients has died of uraemia; the other had, a short time ago when last seen, an infection of his remaining hydronephrosis but showed no evidence of failing renal function.

In 1911 I saw a woman of forty-nine with bleeding from her right kidney. The bleeding had extended over twelve months. After a further period of six months, during which time she bled for all but two weeks, her hemoglobin was down to 60 per cent; she had a rather poor color, and a systolic blood pressure of 100 mm. Hg. I was able to get practically no phenolsulphonephthalein from her bleeding kidney but got 37 per cent from her good kidney. Her urine had a specific gravity of 1020; a urea of 2.34 per cent; the urine from her left kidney showed no evidence of renal disease. On that score I cut down and removed her right kidney which weighed 185 grams instead of about 150 grams. This kidney showed changes in the glomeruli and in the intertubular tissue. One pathologist said he felt sure the other kidney must be diseased; another said that he was not sure about it. This patient made a slow convalescence. Several months later her hemoglobin had risen to 85 per cent. I lost sight of this patient until 1923 when her doctor told me that she had a systolic blood pressure of 250 mm. at times and all the evidence of an advanced chronic nephritis in the remaining kidney; her condition was much the same on May 1, 1925; I do not doubt that simple decapsulation of the bleeding kidney or at most nephrostomy would have stopped her hematuria and would have allowed the saving of sufficient renal tissue to have carried this patient along comfortably for a longer period, perhaps a considerably longer period.

Some years ago a man of twenty-six came to see me complain-

ing of rather severe pain in his left loin. As a considerable number of previous x-rays had not given anything definite, I congratulated myself upon finding a very small shadow, perhaps 2 to 3 mm. wide in this man's left kidney and I advised its removal. In my search for this very small stone I injured the kidney to such an extent that I did not dare to leave it. One may say in this instance that an accident of surgery led to this misfortune, but I believe that my misguided enthusiasm in attempting to operate upon a stone which was still too small to be really operable, my failure to get an accurate surgical perspective, was the trouble. When last seen this man showed no evidence of renal insufficiency, and I trust that he never will, but we know that in a considerable proportion of cases there is a tendency to the bilateral formation of renal stone and that with one kidney doing all the work, the tendency is probably somewhat increased. I regret to say that a similar experience happened in still another case.

As I have gone over my own cases and some others that have come under my observation, I have come to the conclusion that there are two factors that incline us toward radicalism in renal surgery. The first is our knowledge that one normal kidney is more than adequate to carry on the work of urinary excretion; this, combined with our desire to give complete relief and our experience that our conservative operations have not always done this, tend to make us willing to sacrifice a little renal tissue in the interest of a quick recovery: the second is that our more accurate methods of diagnosis of renal disease, methods by which we are able to recognize much lesser lesions than it was possible to do formerly, have rather distorted our perspective, causing us to put an over-great importance on relatively slight variations from the normal and at times to attempt a surgical idealism that is not true conservatism.

There are certain conditions in which there need be no thought of conservatism as for instance in the presence of any form of malignant disease of the kidney, whether it be hypernephroma, papillary carcinoma, or sarcoma.

A tuberculous involvement, limited so far as we can determine to one kidney, is in my opinion a definite indication for nephrec-

tomy although the frequency with which, some years later, we find tuberculous disease appearing in the remaining kidney raises occasional doubts in one's mind. Totally destroyed pus kidneys are definite indications for nephrectomy, as are large hydronephrotic sacs.

With the above conditions the kidney is either doomed to destruction or is already destroyed; no conservative measures will be of the slightest avail. Several of the types of renal disease unfortunately show a tendency to be bilateral or if the disease is not bilateral when first seen shows a tendency for the same condition to develop in the second kidney at a somewhat later period. This I believe makes it incumbent on us to conserve to the greatest degree possible any renal tissue that a patient with this condition possesses. We must, if possible, make the patient comfortable but there is a point beyond which we are not justified in sacrificing renal tissue for mere comfort. We must recognize that freedom from discomfort, possibly even freedom from renal pain, may at times be purchased only at a price in renal tissue that is greater than the individual can afford to pay.

I remember some years ago being greatly shocked by an amputation of the lower leg that was done simply and solely to avoid the care of a varicose ulcer. The mutilation seemed to me greater than the discomfort warranted and yet the patient's loss in that case was really small when compared with that of a patient who has been subjected to an unnecessary loss of renal tissue. An amputated leg may be replaced after a fashion by an artificial limb; renal tissue, however, cannot be replaced and while one starts life with an adequate supply, one has none to waste.

The cases in which I think there is a tendency to do radical renal surgery, and in which it is especially important that we try to develop conservatism are the suppurations, the calculus cases, cases of hydronephrosis, the so-called causeless hematurias and the rare instances of nephralgia.

An important step has already been taken in the conservation of renal tissue in that now one almost never hears any one advise nephrectomy in those very acute inflammations of the kidney, the so-called hematogenous infections, for which nephrectomy

was so strongly advocated a few years ago. It is pretty generally conceded that most of these patients get well without any operative treatment although decapsulation or nephrostomy may occasionally be indicated.

In the case of the non-tuberculous renal suppurations, it is impossible to say just where we should draw the line between the cases that should be treated conservatively and those that should be subjected to nephrectomy. I do believe, however, that we should be very slow to remove any suppurating kidney that has a fair function without a thorough try at conservative measures, irrigations perhaps in the lesser degrees, and drainage through the loin in the more advanced stages. Double renal suppurations are very common and if there is suppuration in the second kidney, no matter how little, one should be especially cautious about doing a nephrectomy. I have little confidence in the tradition that the removal of a suppurating kidney will cause a slight suppuration in the other kidney to clear up. More often a condition of this sort will indicate the beginning in the second kidney of a suppuration similar to that in the side first involved and should be taken as a contraindication to nephrectomy under anything but most unusual conditions.

With kidney stones, even when these are not very large, and in instances where the kidney shows a fair functional ability, there seems to be a tendency to radical operation. The frequency with which stones recur might seem to justify this. On the other hand, the frequency with which renal stones are bilateral (in 18 per cent of some cases I went over a year or two ago) makes it imperative that the patient with a fair renal function first be given the advantage of a nephro-lithotomy, resorting to the radical operation only when palliative measures have proved ineffective. While it is very important to remove a renal stone before it becomes large enough to produce any considerable destruction of kidney tissue by pressure or if possible before infection has taken place, yet attempts to get very small stones are often unsuccessful and when one persists in one's search for them he may injure the kidney to such an extent that it has to be removed.

Another condition which is very apt to tempt us to radical operation is a moderate degree of hydronephrosis or hydronephrosis and hydroureter. One reason for this is that on the whole our plastic operations in cases of hydronephrosis have not been unqualified successes and nephrectomy offers an easy and sure way to rid the patient of his pain. Unfortunately hydronephrosis is found to be bilateral in an increasing number of cases and in the instances where this condition is of slight or moderate degree we should exhaust our means of conservative treatment before doing nephrectomy. In the great hydronephrotic sac conservation is impossible.

The cases of so-called "causeless" or "idiopathic" hematuria offer a considerable field for the exercise of conservation. These hematurias are usually the result of a nephritis of some sort. At times this nephritic process involves the kidney generally, at other times but a part of it; in rare instances the bleeding is the result of an infarct. Decapsulation, or at most nephrostomy, will in my experience almost invariably control this condition. The clinical case that I reported in the first part of this paper illustrates the undesirability of nephrectomy in cases of this sort.

From time to time we see patients who complain of great renal pain without showing any considerable kidney lesion. These cases occasionally are submitted to nephrectomy in sheer desperation. Such cases as I have seen have been in neurotic women and decapsulation has given temporary relief, at least; in one case that I followed, this relief had lasted for some years at the time the patient disappeared from sight.

I perfectly well appreciate that my suggestions are decidedly utopian in character, that there are many limitations to our diagnostic ability, and that many factors interfere with our ability to estimate accurately the worth, to a patient, of a given kidney. I also appreciate that many patients have renal conditions which make the prolongation of their lives for any length of time quite impossible, no matter what course one pursues, but I believe that there are others and quite a considerable number, in whom the wise conservation of renal tissue may prolong life for perhaps an appreciable period. It is true that at times this prolongation of

life may have to be purchased at some loss of comfort, perhaps even at some more or less degree of invalidism.

If we will keep before us the importance of saving as much renal tissue as possible and approach all renal operations with this in view, we will, in many cases, effect a definite lengthening of life. Naturally the more we attempt conservative measures the more expert we shall become in their use and the more successful they will be.

END RESULTS IN RENAL INFECTIONS

WM. C. QUINBY

Boston, Massachusetts

Received for publication June 15, 1925

As my contribution to this symposium on renal surgery, at the request of our secretary, I have chosen the subject of the *end results of cases of renal infection;* especially as influenced by pre-operative and post-operative care. To illustrate this subject I have chosen representative cases from among the last hundred operated on at the Brigham Hospital. No cases of pyelitis only are included, for this type of case but rarely needs operative treatment. In all cases therefore, there was present definite lowering of the function of either one or both kidneys.

Viewed as a whole the cases fall naturally into three groups, viz.:

I. Infections ending in death
II. Infections ending in cure only after nephrectomy
III. Infections ending in preservation of the kidney
  a. With continuing infection
  b. With subsidence of infection

As illustrating the first group a single case may be quoted in brief abstract.

A man of fifty-nine, a lawyer and later postmaster, entered the hospital acutely ill. After a winter of ill health characterized by several attacks of so-called "grippe," followed later by furunculosis which still exists, he was seized two months ago with painful urination which soon gave place to inability to empty the bladder. For this he has been using a catheter intermittently, and has recently suffered from increasing pain, both during and after urination. There

has been considerable vesical tenesmus and this in turn has given rise to anal spasm. He has just experienced another out break of boils. No enlargement or tenderness of either kidney can be palpated. A suprapubic cystotomy was performed with some relief of the discomfort in the bladder. His general course, however, was speedily downward, death following with the picture of an acute pyemia with chills; bloody, turbid urine and terminal broncho-pneumonia. Autopsy found a bilateral suppurative pyelonephritis and an obstructive enlargement of the middle lobe of the prostate, as well as the terminal lung condition.

Such a case is typical of the first group and obviously offers much for criticism of its medical conduct during the days and weeks preceding entrance to the hospital. Certainly some one should have made a proper diagnosis and not been content to call attacks of undoubted urinary fever, "grippe." Someone also should have prevented his misguided efforts of self-catheterization. Could any more have been done after operation and adequate diagnosis had been made? I do not think so when seen; today he might conceivably be found to be one of those who respond so marvelously to the intravenous injection of mercurochrome. Had such a drug been then available it certainly would have been used.

Cases illustrating the second group—those cured only by sacrifice of the kidney by nephrectomy are of course in marked majority. A careful history will show in almost every instance of this group evidence of antecedent infections, sometimes years old, often with remissions of symptoms over considerable periods of time.

Such a case is that of a janitor of thirty-eight whose kidney on removal was described by the pathologist as "essentially a large pus sac—9 x 15 x 7 cm. with practically no normal kidney tissue to be seen." In his previous history we read that for a period of five years he had a chronic, discharging ear. A year later, four years ago, he had an attack of hematuria lasting two or three days. Only three months ago there began an acute sharp pain in the right lumbar region accompanied by bloody urine.

Again, we meet with a similar train of events in a woman of

thirty-five who had had recurrent attacks of tonsillitis for fifteen years. Three years before entrance to the hospital she noticed that the urine was turbid in appearance, but there was no bladder discomfort. A year ago there occurred an attack of hematuria without pain, lasting a week. Only since about a month has there been pain in the right flank. The kidney on this side was found on removal to be almostly entirely destroyed by chronic and acute suppuration.

Such cases illustrate the well known secondary involvement of the kidney by infections present in chronic foci of all sorts. We also find in this group cases due to the pyelitis of pregnancy persisting unheeded after the delivery; a case following traumatic rupture of the kidney, one following stricture of the urethra with phimosis, one following chronic sepsis of joints, and in one instance infection and destruction of the kidney followed a chronic leg ulcer in a woman who was also a diabetic.

Too much stress cannot be made of the clear duty of all, especially that of the family physician who first sees these patients, to do everything in our power to eradiate any and all chronic foci of bodily infection wherever possible.

But considering the immediately pre-operative conduct of these cases of unilateral infection of the kidney what are the indications for treatment? In many cases we find the destruction of the kidney so definite and marked as to demand nephrectomy, forthwith, waiting only for the usual preparation of the bowels, preferably by enema, and reasonable forcing of fluids. Often such patients show considerable malnutrition with slight pyrexia and leucocytosis which in my experience is best and most promptly relieved by removal of the infected kidney. It is frequently most gratifying to note the prompt return to normal health, with marked gain in weight and general appearance which this type of patient makes. Occasionally also one finds that a prompt nephrectomy is indeed a life saving measure.

In such cases of renal infection, otherwise uncomplicated, I have had no deaths. At times, however, the operation is a severe one. In two instances removal of the kidney had to be accomplished in two stages due to the precarious condition of

the patient. In two other instances a second operation became necessary to remove a pyo-ureter causing pain and persistence of vesical infection.

Immediately following operation patients are usually given salt solution under the skin. The most troublesome post operative complication I have found to be meteorism, due to a temporary paralytic ileus. This seems to be in direct proportion to the adhesion of the perirenal tissues to the posterior surface of the large bowel, and the amount of trauma necessary to their removal. It seems also to be more common after the removal of the left kidney. It is treated by the usual measures of hot stupes, enemata, rectal tube and pituitrin; and occasionally I have found marked relief to follow rolling the patient over so that he lies on his belly.

So much for the cases only cured at the expense of a destruction operation. The most interesting group is the third one in which the kidney can be preserved. Unfortunately it is not a very large one. Here we find definite infection, but with evidence of some remaining renal function as judged by the phthalein output. After careful general examination of the whole body seeking for a distant focus for the renal condition, and after satisfactory x-ray films have excluded stone, the kidney and whole ureter on the affected side should be studied for possible mechanical cause for stasis by a pyeloureterogram. At times it is of help in this regard to study the emptying of the injected pelvis and ureter under the fluoroscope. Direct attack on the infection in such a kidney by the frequent exhibition of antiseptics is desirable and for this purpose I find the use of the inlying ureteral catheter is of great benefit. Constant drainage of the kidney promotes recovery by the relief of stasis while at the same time mercurochrome or other antiseptic can be injected into the renal pelvis at frequent intervals, say from two to four times daily. The introduction of more than one catheter into the single ureter has been carried out, but a better arrangement is the two way ureteral catheter recently produced by Eynard. Such catheters should be as large as No. 8 or No. 10 F. over all as the smaller sizes are too readily prone to become plugged. In my hands this use

of the inlying ureteral catheter, I am sure is a definite step in advance in promoting recovery of a kidney from infection.

A recent case is that of an Italian woman of forty-eight who presented a pyuria and pain in the left kidney. Investigation showed infection of both kidneys by the colon bacillus. In the right kidney was a moderate sized branched stone, but there had been no symptoms on this side. The left kidney was larger than the right, but was free from stone. The blood urea nitrogen was only slightly elevated, but the total phthalein output over a period of two hours was only about 18 or 20 per cent. Divided renal function showed but a trace of phthalein from the left kidney. A two way inlying ureteral catheter was placed into the left kidney and through this during the next four days frequent injections of mercurochrome in 10 cc. amounts of a 1 per cent solution were made. At the end of this time there appeared a slight diarrhoea with stool definitely colored red by the mercurochrome. The catheter was removed and at its subsequent introduction a week later the urine still contained the colon bacillus. A second similar course of treatment resulted in the complete sterilization of this kidney which has persisted for somewhat over two months. Together with this cessation of infection there has been an appreciable gain in renal function and the patient is about to enter this hospital now for removal of the stone in the right kidney; after which a similar attempt will be made to render this organ sterile by the same method as has been successful in the left kidney.

As mentioned above careful search should be made for evidence of renal stasis from mechanical cause, and when found or even when only strongly suspected, such cause should be relieved by open operation. Although the tortuosities of the ureter seen at times may be and probably are of a secondary nature, and not the primary reason of an infection; investigation, by microscope, of the strands of tissue surrounding such kinks has shown them to be made up of scar, containing chronic inflammation. In several instances of this sort, I have seen the kidney become free from infection after a ureterolysis and suspension of the organ by fixation sutures.

Interference with the ureter by anomalous vessels forms another variety of such mechanical cause for stasis and infection. In one of the two recent cases of this sort to be published in detail elsewhere, the kidney was found held down in an abnormally low position by an accessory artery taking origin from the aorta at about its bifurcation and running slightly upward and outward to enter the lower pole of the kidney. This organ showed infection with definite lowering of function. Interestingly, the ureter seems to be of normal length, and to be thrown into several tortuosities by reason of the low kidney position. The abnormal vessel was divided, the ureter straightened and the kidney easily brought to a normal height where it was held by fixation suture. Following this operation all former pain disappeared and the infection is already nearly conquered.

Such instances as these need not be multiplied. As a group they form by far the most interesting one for in them we may feel that our efforts are constructive and conservative, in contrast to the destructive nephrectomy. Preservation of renal tissue wherever possible and compatible with health should, I feel, be our constant aim.

In concluding, I would emphasize the following points:

A kidney is capable of withstanding a very considerable amount of infection without loss of all its factor of safety in renal tissue.

The course of infections of the kidney is usually of long duration, symptoms of a general sort, being often slight and to be found only on careful investigation—intermingled by exacerbations of greater or less severity which attacks are not rarely erroneously attributed to "grippe," "lumbago" or "biliousness." Localizing symptoms, either of kidney or bladder, are frequently absent especially in the earlier months of the infection and between the acute attacks.

The possibility of restoring a kidney to a state of healthy activity and of preventing continuance of renal damage should be better appreciated by both the family physician and surgeon. In many an instance there is abundant opportunity for a much earlier diagnosis than is usually made.

Institution of treatment at a time preceding that at which the kidney has become badly crippled in its structure and overwhelmed by infection will avoid many nephrectomies.

For this purpose the method of frequent renal lavage through the inlying ureteral catheter, which at the same time relieves stasis, is of great benefit.

THE RÔLE OF NEPHROSTOMY IN GENITO-URINARY SURGERY

ARTHUR H. CROSBIE

Boston, Massachusetts

Received for publication June 15, 1925

By the term nephrostomy I refer to any operation in which drainage is established through a kidney to the kidney pelvis, whether this drainage be temporary or permanent.

I was stimulated to say a few words on this subject by reading in two different text books, on urology, a description of the operation for splitting the kidney for the removal of large branching calculi. One advocated drainage only in the presence of extensive infection, while the other made no mention of drainage of the kidney and advised merely drainage of the wound to the kidney. I feel very strongly that a kidney should never be opened for any cause whatsoever without leaving drainage to the kidney pelvis. For this drainage I prefer a rubber tube. It is impossible to open a kidney and then close it without an accumulation of blood clot in the pelvis, which is more than the pelvis and ureters should be asked to take care of. Of course, in most cases the clots will pass off satisfactorily, but in some grave trouble arises. If infection is present, as is nearly always the case in the presence of calculus drainage is of especial importance.

I think that failure to drain after a nephrotomy is seen more often with the general surgeon than with the specialist. I have had the opportunity to see two cases in which a nephrotomy was done for the removal of calculi by general surgeons where closure of the kidney produced disastrous results. One case developed an overwhelming infection from which the patient died, while the other had persistent hematuria for twenty days

after operation, becoming very anemic. In this case I advised nephrostomy which was done. Drainage was left in for a week with entire subsidence of the bleeding. I think that in this case the pelvis became overdistended with blood clot and a persistent oozing followed. With a rubber tube to the pelvis you can rest assured that there is free drainage for whatever bleeding occurs.

The operation that I use for a simple nephrostomy is as follows: The kidney is grasped firmly in the left hand with the fingers in contact with the kidney pelvis. A nick is made through the capsule at the junction of the middle and lower thirds, just posterior to the median line. A closed half-length clamp is then passed through until the end can be felt in the kidney pelvis, by the fingers of the left hand. The clamp is removed and either the little or forefinger of the right hand is introduced into the kidney pelvis. Following this a rubber tube, about $\frac{5}{16}$ inch in diameter is passed to the pelvis. The bleeding at first is rather profuse, but generally subsides quickly after the tube is in place and the kidney is dropped back into position. If the bleeding persists enough to be alarming a deep catgut suture can be placed on either side of the tube and tied gently, or a wisp of gauze may be packed in along side the tube. As a rule neither of these procedures is necessary. The length of time that the tubing remains in place depends entirely on the nature of the case. I never remove the tube in any case before the fifth day. Provided there is no obstruction to the ureter the nephrostomy wound heals readily.

I do not recommend nephrostomy for every stone in the kidney, but I do feel that if a stone is very large or there is much hydronephrosis, such as you get from a stone forming a ball valve in the ureter or in the presence of much infection, a nephrostomy should be done. Many times after removing a stone by pyelotomy I then do a nephrostomy. The damage to the kidney by such an operation is slight. The drainage is important to relieve the infection and also to drain out small particles of stone that may be left. Then too there are those cases where there is so much kidney destruction and low function that the question of a

nephrectomy comes up. I feel that we should be conservative and save every kidney possible. Many times after removal of stones, under prolonged drainage, sufficient function will return to make it worth while to save the kidney, if not it is a simple matter to do a secondary nephrectomy.

Nephrostomy is the operation of choice in obstructive anuria. Unless the case is caught very early, I am not content merely to remove the obstruction. Let me cite a typical case. Five years ago a woman of sixty years was sent to me with complete anuria for three days. Several years before she had had her right kidney removed for stones. She looked sick, with rapid pulse and her temperature was 103°. She had a large tender mass in the left kidney region. I passed a catheter up the left ureter to determine where the obstruction was. The catheter passed with ease to the kidney pelvis. Forty cubic centimeters of turbid fluid was withdrawn. At this point I stopped. It is quite possible that I could have drained her by catheter and got away with it, but it seemed to me that it was imperative to get immediate and adequate drainage. Under gas oxygen anaesthesia I cut down on her left kidney and found it much enlarged, covered with fibrous exudate and the pelvis much dilated. I could find no obstruction to the ureter. I did a nephrostomy and got out. The patient made an uneventful convalescence. The tube was removed on the tenth day and the nephrostomy wound healed readily. I heard from this patient recently and she has had no further trouble. I think she had an acute pyelonephritis and the ureter was plugged with pus and mucus.

Double nephrostomy gives more relief than anything else I have found for the cases of double chronic pyelonephritis with with megaloureters. I am not sure but what permanent nephrostomy gives these people the best chance. Cases of this sort on which I have used this operation have improved markedly under drainage, but have gradually relapsed after the nephrostomy wounds have been allowed to close.

In cases of long standing unexplained renal hematuria I prefer to do a nephrostomy in addition to decapsulation. Four months ago I saw a man of thirty-two, at the Chelsea Naval

Hospital, who had had constant left hematuria for seven years. During that time he had never once seen his urine normal in color. He had been cystoscoped many times and nothing found, except that the bleeding came from the left side. Repeated guinea-pig inoculation was negative and there were no more leucocytes than could be accounted for by the blood. I explored the left kidney and found it normal in appearance. It was freely movable, but there was no obstruction to the ureter. I opened the kidney and explored the pelvis and calyces and could find nothing abnormal. A rubber tube was left to the kidney pelvis. The kidney was then decapsulated and a nephropexy done. At the end of ten days the tube was removed and in ten more days the nephrostomy wound was entirely closed. Three days after operation the bladder urine became clear and has remained so. At the end of a month the urine contained no microscopic blood and has remained free of it. What the drainage did for this kidney I do not know. It is possible that decapsulation would have had the same result, but in such a long standing condition I prefer the more radical procedure.

In renal tuberculosis I much prefer not to do a nephrostomy. The wound always becomes infected and the danger of disseminating the disease is great. This operation should be reserved for only desperate cases where a nephrectomy is out of the question.

In infected hydronephrosis and in pyonephrosis where the patient is sick with sepsis a nephrostomy under procain is often a life saver. After draining such a kidney until the temperature is down the nephrectomy becomes a much simpler operation. In closing let me reiterate my belief that a kidney should never be opened for any cause whatsoever without leaving drainage to the kidney pelvis.

A FEW CASES OF TWO-STEP NEPHRECTOMIES

NATHANIEL G. ALCOCK

Iowa City, Iowa

Received for publication June 15, 1925

Wherever nephrectomy is indicated, with the possible exception of cases of early renal tuberculosis and some cases of non-infected hydronephrosis, the operation is always attended by difficulties that tax the skill and judgment of even the most competent surgeon. Tumors by their great size, as well as by their enormous blood supply, present invariably technical problems. In kidney infection where nephrectomy must be done, the surgeon is confronted not only with the technical difficulties of delivering the kidney and dealing with the pedicle, but also with the general condition of the patient, which is very frequently so bad that the question of his being able to stand a prolonged major operation is always foremost. It has been long recognized as pointed out by Quinby, Caulk, Chute, Bugbee and others, that any procedure that will decrease the technical difficulties or that will improve the patient's condition previous to nephrectomy is justified. One may even make the latter portion of this statement broader, I believe, and say that any procedure in the extreme cases is justified if it will improve the patient's condition more than it increases the difficulties of nephrectomy. The surprising low mortality of primary nephrectomy is not an argument against any procedure aimed to make it lower. Furthermore, the indication for a nephrectomy in renal infection is becoming more restricted, and those very procedures aimed to reduce the risk of the operation are saving kidneys.

Caulk and Bugbee have stressed the importance of preoperative treatment, especially catheter drainage, in nephrectomy,

and Caulk has said that the catheter possesses a therapeutic triad; namely, preparation, conservation and cure. Catheter drainage, however, is impossible in some cases and insufficient in others. In the cases here discussed it has been used wherever possible.

The dividing of a nephrectomy into two stages has been a procedure employed by surgeons, both intentionally and otherwise, for many years, but a great deal has not been written on the subject for one or two reasons. In the first place, it is indicated in only a very small proportion of the cases, and in the second place, when carried out it is a procedure not infrequently forced upon the surgeon after he has tried to do a primary nephrectomy, and may have been due to his inability to gauge the true condition of the patient or to his lack of technical skill or courage, and he may feel that it is, in a way, an evidence of failure, and, therefore, say little about it.

There have been two distinct surgical operations advocated for two-step nephrectomy. One is aimed primarily at reducing the difficulties of the nephrectomy by first ligating the renal pedicle transabdominally. This was suggested by Walker, in 1905, and two years later, Holt reported one case where four attempts at nephrectomy had failed. In 1912, Kellock reported one case where two attempts at nephrectomy had failed. In 1921, Quinby discussed the operation quite in detail and concluded that it was a procedure justified and to be recommended in certain cases of renal tumor and even in the more difficult cases of renal tuberculosis. During the past year and a half, Eisendrath has reported cases operated by this method, and also some experimental work done along this line. Each of these writers emphasizes the fact that the ligation facilitates the secondary removal, and two of them mentions cases where the ligation obviated the necessity of secondary removal.

The second type of two-step nephrectomy is the one in which a preliminary nephrostomy is done for drainage. It is the one, as pointed out by Chute, that is sometimes intentionally done, but more often is forced upon the surgeon by difficulties arising during the course of an attempted primary nephrectomy. Caulk,

in 1917, discussed the procedure and said that it was indicated only in a very small group of cases, especially in children with mammoth infection of the kidney, and otherwise overwhelmed by sepsis and toxemia. Bugbee, in 1921, said, "That preliminary drainage of the kidney had saved two of his patients who unquestionably would not have survived a primary nephrectomy." Cahill, in the same year, said that this procedure was recommended by some operators, but that he felt that, as a rule, cases requiring deliberate delay did not occur in renal surgery.

Chute, in 1920, in a paper on, "Secondary Nephrectomy," discusses the subject of a two-step nephrectomy in detail and points out many things about the technique. He divides the cases of secondary nephrectomy into two classes. The first class is made up of those cases where the operation was intentional, and in his series of twenty, nine fell into this group. Into his second class he places those cases where the operation was forced upon the operator, either by difficulties arising at the time of operation, or by errors of some sort either in diagnosis or judgment. He feels that a two-step nephrectomy in a very limited group of kidney infections is life-saving. He brings out many valuable points in the technique as, the inclusion of the sinus in the second incision; the necessity of freeing the kidney posteriorly first; the care to be taken in the reflection of the peritoneum; and the difficulties met with in dealing with the renal pedicle. In dealing with the pedicle he prefers, if possible, to ligate the entire pedicle before a clamp is put on, and then to follow this up with the reinforced ligatures. He says that the preliminary nephrostomy makes the secondary nephrectomy more difficult, and that the difficulty is increased by the time that elapses between the first and second operation. He also infers that the increased difficulty is more than compensated for by the decrease in the size of the kidney and the very great improvement in the patient's condition.

I have done a preliminary nephrostomy in fifteen cases, and in two other cases have done a nephrectomy where the preliminary drainage had been carried out before the patient came under my observation. The fifteen cases can be divided, as Chute divides

his, into two groups. Group A, where I intentionally started to do a two-step nephrectomy, comprises ten cases. Group B, where I started with the intention of doing a primary nephrectomy, but was compelled during the operation to limit it to a nephrostomy, comprises five cases.

In group A there were four cases of renal tuberculosis, two cases of pyonephrosis and four cases of infected hydronephrosis. Stones complicated one case of hydronephrosis and one case of pyonephrosis. A perinephritic abscess complicated one case of tuberculosis. All of these cases were in such exceedingly bad condition, due to sepsis, that I felt that all that they could possibly stand was a simple drainage of the kidney. In all of these cases, catheter drainage had been attempted. In four of them it was impossible on account of the inability to pass a catheter up the ureter, and in the other six it was insufficient.

Two of the cases of tuberculosis in this group never came to their second operation. They were very similar in many respects. Both were bilateral infections with very large left kidneys, and only slight involvement of the right kidney. Both had active pulmonary lesions and in both cases the left kidneys were secondarily infected and the patients were exceedingly septic and the prognosis in each case was exceedingly bad. In these two cases there was little likelihood of their ever coming to the second operation. One was helped very little, although his sepsis was relieved. He died six weeks later of an acute miliary tuberculosis, which I think had nothing whatsoever to do with the operation. The other case was very much relieved. The sepsis disappeared immediately and her general condition was very markedly improved. Her pulmonary condition became better and she lived in comparative comfort for something over eighteen months, and died at the end of about the second year of a pulmonary infection. She never had any further serious trouble that could be attributed to the renal condition.

Of the other eight cases in this first group, four have had their kidneys removed and the other four are now in the interval between the two operations. Of the former group, two were infected hydronephroses, one a pyonephrosis and one a tuberculo-

sis. I will give the findings of the tuberculosis case in more or less detail, as it illustrates the other cases very well. This was a case of renal tuberculosis in a boy seventeen years of age, whose symptoms dated back five years, and who had been growing steadily worse, especially during the six months immediately preceding his admission to the hospital. During these months he had developed attacks of chills and fever and had lost nearly forty pounds in weight. On admission his weight was ninety-one pounds. His general condition was exceedingly bad. He was very septic and the prognosis was given as grave. The left kidney was very large and tender and completely filled the left flank. It seemed to be almost as large as a child's head. Its function was nil. Catheterization of that ureter did not lower the temperature, and cystoscopy made him worse. The pus from the left kidney showed a few tubercle bacilli and many colon bacilli. The right urine contained a few pus cells, and a guinea pig inoculated with the right urine was later reported positive. A nephrostomy was done through a very short incision and only the lower portion of the kidney was exposed. There was much inflammatory tissue about the kidney, which bled very freely. Good drainage was established by an opening into a large tuberculous pyonephrosis, from which a very large amount of pus was evacuated. The improvement was immediate and rapid. In six months thirty pounds had been gained. His general condition was excellent and his bladder symptoms had so changed that he was sleeping for four hours without getting up. Previous to the operation he had been voiding every thirty minutes day and night. A nephrectomy was done, and I was surprised to find much less difficulty than I had anticipated. After I was once beyond the scar of the first operation, the enucleation of the kidney, which had decreased to fully one-fourth of its original size, was no more difficult than I have found in some cases of primary nephrectomy. The plane of cleavage was fairly good and the inflammatory tissue, while quite dense, was comparatively dry and the hemorrhage was comparatively slight. Isolation of the pedicle was no more difficult than it would have been at the primary nephrectomy. The recovery was uneventful. In this

case a nephrectomy, I am sure, was as easy, the loss of blood less, and the time consumed no more than if I had done the entire operation at one sitting. Of course, the patient's condition was entirely changed.

The septic and general condition of the two patients of infected hydronephrosis of this group seemed to absolutely contraindicate a primary nephrectomy. An enormous amount of pus was drained by the nephrostomy in each case. The gain in weight of both patients during the interval was excellent. In both cases the freeing of the kidney at the second operation was difficult until the field of the first operation was past, and from then on by using care the anatomical relations were identified and the difficulties seemed to be no more than one finds at a difficult primary nephrectomy. In both cases the kidneys were only a fraction of their original size. The same thing can be said in reference to the case of pyonephrosis.

In all of these cases I made it a point to make the primary incision only very short. In one of them it was only about two inches long, and in this way the amount of scar tissue to be dealt with at the second operation was reduced.

The four patients who have had their first operation but not their second, comprises two cases of renal tuberculosis, one of pyonephrosis with stones, and one with infected hydronephrosis. One of the renal tuberculosis cases had a perinephritic abscess. Both of the cases of tuberculosis had enormous masses in their right side. In one case the kidney was as large as a child's head. Both cases were septic and the prognosis at the time of admission was very bad. One of the cases has improved only moderately in nine weeks, but there are now no symptoms of sepsis. She has gained about eight pounds, and the kidney is much reduced in size, and is movable. The other case has gained 45 pounds in nine months, and did so well that only recently she decided to allow a second operation. The decision was due to the temporary closure of the sinus with a development of fever for three days. Her kidney is very much reduced in size and is now quite movable. In this case, too, there was a marked renal insufficiency in the left kidney.

The case of pyonephrosis with stones was very septic on admission and had a very large mass occupying the left flank from the kidney bed posteriorly to the brim of the pelvis below and extending over to the umbilicus. Her weight was seventy-two pounds. Fully two quarts of very foul smelling pus was evacuated and a large, soft stone was found. The operation did not consume more than fifteen minutes, but at that, the patient was in extreme shock. The anesthetic was ethylene. Her convalescence and gain was very slow. She was operated six months ago, and only during the past three months has her improvement given any promise. The size of the left kidney is now very much reduced and it is slightly movable, and I believe that she will be in a condition in another four weeks that will permit the removal of the kidney.

The fourth patient in this group was admitted two months ago. He had a very large infected hydronephrosis on the left side. He was sixty-nine years of age and looked fifteen years older. His symptoms indicated that he had had a hydronephrosis for many years, and that it had been infected and producing symptoms of infection for many months. His general condition was exceedingly bad. Catheter drainage relieved him of his temperature for forty-eight hours and then he became worse, and a very bad prognosis was given. The left kidney was drained under a local anesthetic, and a large amount of purulent fluid was removed. The amount of drainage during the next two days was enormous. Improvement was rapid after the third day, and in two weeks he left the hospital, gaining very satisfactorily. The kidney mass had entirely disappeared. I feel sure that this patient would not have stood a primary nephrectomy, and it is a question in my mind at his age whether a secondary nephrectomy shall ever be attempted.

Of the five cases in group B, where I started with the intention of doing a primary nephrectomy, there are four cases of renal tuberculosis and one case of pyonephrosis with stones. In all of these cases I only drained the kidney at the first operation for one or both of the following reasons:—either I met with difficulties at the first operation that I could not surmount, or the patient's

condition during the operation became so bad that continuation was out of the question. Two of the cases of renal tuberculosis will not consent to the second operation. Both of them have improved so much that they are now in good health, and for that reason see no necessity for the second step. One of them had an exophthalmic goiter, which improved very much following the kidney drainage and is now giving her very little trouble. She has since gone through a normal pregnancy. She has very slight drainage from the kidney sinus and the urine is clear, and she has no bladder symptoms. The other of the two of these two cases of tuberculosis was in the best of health when last seen. The kidney mass had disappeared and could not be palpated; there were no bladder symptoms and the urine was negative. The sinus had closed and there was no drainage whatsoever.

Of the remaining three cases of this group, two were tuberculosis and one a pyonephrosis with stones. Of these three cases the primary operation showed that a nephrectomy, at best, would have been very difficult. The kidneys were very large, the amount of inflammatory tissue about them very great, and in attempting to free the kidney the surrounding tissues bled very freely, and in one of the cases I am sure the hemorrhage had a great deal to do with the condition of shock that came about. Improvement in the interval was very great, and while the secondary nephrectomy was more difficult than it had promised when first attempted, the condition of the patients was so much better that they stood the long procedure without causing the least anxiety, and I feel sure that the preliminary drainage saved their lives. In each case the decrease in the size of the kidney was very marked and had a great deal to do in facilitating the removal. It was noted in each of these cases that the tendency of the surrounding tissues to bleed was much less than at the first operation.

In the two cases where a preliminary drainage had been carried out previous to their coming under my observation, one was a case of infected hydronephrosis and the other was a traumatic rupture of the kidney followed by infection. The hydronephrosis case had been operated twelve years previous to his admission to

the hospital, and an anterior gall bladder incision had been made. I do not know what the pre-operative diagnosis had been. The patient said that he was exceedingly sick and not expected to live. He was told that an infected cyst was found, and apparently it was not recognized that this cyst was an infected hydronephrosis. It was drained, and for twelve years he carried on his work as a painter, wearing a tube in the abdominal sinus. The nephrectomy in this case was comparatively easy until the sinus was reached, and even here no great difficulties were met with. The blood supply to the remnant of the kidney was small. In the other case an abscess had followed apparently a traumatic rupture of the kidney, and an anterior abdominal incision was made and a large abscess drained and continued to drain through the abdominal sinus for four years before the patient was admitted to the hospital. A lumbar nephrectomy here was done and the freeing of the kidney was exceedingly difficult, especially at the point where the sinus came into the kidney. The blood supply again was small. The recovery in both cases was uneventful.

This series of cases has taught me a few things. In the first place, I believe that nephrostomy, as a preliminary to nephrectomy in infections of the kidney, is clearly indicated in a very small group of cases. The size of that group of cases is in proportion to the surgeon's conservatism and to his lack of skill and courage. In these cases, I believe, with Bugbee, Caulk, and Chute, that it is a life-saving procedure. I agree with Chute that the preliminary nephrostomy makes the freeing of the kidney more difficult, but I also believe that the decrease in the size of the kidney, the improvement of the patient's general condition, and the decrease in the tendency to hemorrhage, compensates for the increased difficulty. I heartily agree with Chute in the points in technique that he brings out. The sinus, if possible, should be included in the second incision. The kidney should be freed posteriorly first, and then around the lower pole, and the greatest of care is necessary in reflecting the peritoneum. I believe that it is safest, if possible, to ligate the pedicle with one ligature before clamps are put on. After that, any further procedures

possible in controlling the hemorrhage from the pedicle are to be recommended. I like to put on a primary ligature first, then a clamp and cut off the pedicle as near to the kidney as possible, and as far away from the clamp as possible. I then ligate, if possible, the individual vessels that protrude from the clamp. After that, I put on a transfixed ligature, or a mass ligature, back of the clamp and tie the ligature as the clamp is removed.

In my cases of secondary nephrectomy infection of the wound has invariably taken place, and I do not see how it can be well prevented. It has never caused concern in any case. In my own cases of primary nephrectomy for similar, but not so serious conditions, it has also occurred in a very high percentage of the cases, and in some has been a serious element in the patient's recovery. Of course, in secondary nephrectomy the patient is in a condition to take care of the infection.

Two-step nephrectomy, of course, requires longer hospitalization, but this is not a factor, if the procedure is life-saving.

DISCUSSION

Dr. Edward L. Keyes (New York): Let me first compliment Dr. Shaw on his study of the phenolsulphonephthalein output after intravenous injection. His charts illustrate very nicely the fact that as a routine after intravenous injection, one should take half-hour specimens instead of one-hour specimens, the figures thus obtained being comparable to those we used to obtain in hourly specimens after intramuscular injection.

I am not sure that I follow him in the more intimate study of fifteen-minute specimens, as I do not think that our estimations are quite accurate enough to permit of such fine distinctions.

In the second place, I venture to disagree entirely with Dr. Crosbie's suggestion that it is a good scheme to drain unifected kidneys because one fears the accumulation of blood clots, in the renal pelvis. A little washing out of the renal pelvis at the end of the operation minimizes post-operative accumulation of clot. The current practice of closing the uninfected pelvis of the kidney by a suture including the perirenal fat, is much safer than drainage in that it insures the kidney against infection from the skin through the drain.

In the third place, my compliments to Dr. Alcock upon his methodical and dignified report of cases.

Dr. Thomas F. Laurie (Syracuse): I should like to speak of the danger of hemorrhage in leaving a tube in after a nephrotomy. A patient in which I took a stone from the pelvis of the left kidney through a nephrotomy incision, and then put a rubber tube through this small opening, had a very marked secondary hemorrhage on the same day. It required an operation; that is, we had to reopen the wound, I took the tube out and sewed the kidney up tightly with mattress sutures. He made an uneventful recovery after blood transfusion.

Dr. JAMES A. GARDNER (Buffalo): Dr. Crosbie has brought out a most interesting point in the case reported to have had a hemorrhage without apparent cause, which appeals to me strongly. I have been endeavoring to find the cause of a patient's hemorrhage who has had blood in the urine practically for a year. He has been cystoscoped repeatedly. We know it is from the right kidney. Guinea pigs never have shown anything. On the first specimen, the laboratory reported tubercle bacilli found, but no subsequent finding of it. Function apparently equals the normal side.

After listening to Dr. Crosbie tell of using decapsulation of the kidney or the opening and examining of it, whatever may have stopped the hemorrhage, I shall on returning home follow out the same procedure and hope for success. If the hemorrhage can be stopped as easily as that I am sure the patient will be willing to submit.

Dr. JOHN R. CAULK (St. Louis): There are so many fascinating phases to this subject, that I think most of us would like to talk a long time. Yet I think we more or less agree on this whole subject, except for a few little incidentals. The one feature is that we are becoming more and more conservative.

I agree very thoroughly with Dr. Quinby as to the value of ureter catheter drainage, not only as a method of sparing many kidneys from surgery, but also as a preparatory measure in the treatment of renal infections to relieve toxemias and absorptions and make better surgical risks. The ureter catheter may be left in place with repeated insertions for many months if necessary; it is my custom to change the catheter about every five days to a week.

There are two things which I wish particularly to discuss:

1. The phenolsulphonephthalein test.
2. Interpretation of certain pyelograms.

I feel that the phthalein test has been one of our most valuable aids in urological diagnosis. In my hands I feel sure it has "batted" 100 per cent. It is, however, not without misinterpretations. It is frequently incriminated as valueless; I have heard

physicians make these assertions—"Here is a kidney which when removed looked normal and yet the phthalein was very low;" on the other hand, "here is a kidney that is very poor and the phthalein was fine." They do not realize that the phthalein represents the physiological function at the time of its administration and that it is influenced by conditions in the kidney at the time; infection disturbs the kidney and unless one is careful to recheck and is aware of the transformations of renal function in infection he will get a false impression. The best illustration I know is to compare an inflamed kidney to a person who is sick with the grip; when one is ill with infection like influenza they are incapacitated although when the infection is over their health is restored; this same applies to the kidney. In such cases ureter catheter drainage with repeated functional tests give the index of functional activity.

The interpretation of pyelograms is extremely difficult in many instances. Distortions of the calices are frequently physiological and we must never forget the importance of muscle contractions in the renal pelvis under normal conditions; here again, retake pyelograms are important. Another thing, filling defects in the true pelvis are difficult often of exact interpretation. In cases of hematuria with a filling defect in the true renal pelvis one cannot, of course, tell between the clot and an intrapelvic tumor and the exploration of the kidney as a result of such a pyelogram should be very guarded.

Dr. Alcock has certainly been honest and has given a wonderful citation of his cases in a very delightful way. There is no question about the fact that these very sick people, particularly children with acute kidneys, should be preliminarily drained with a catheter and nephrostomized. Instead of making the operation more difficult, it has in my hands greatly simplified it. Contrary to custom I always freely expose the posterior surface of the kidney in order to have a line of cleavage for the second operation and then if the kidney is freely drained instead of having an enormous mass as one would by primary nephrectomy there is nothing but a small kidney at the second operation which is easily removed by following the posterior line of cleavage. The

second operation should be done within two weeks, if possible, before adhesions are formed to surrounding structures. The longer it goes after this the more difficult we may expect the secondary procedure. With this two-stage operation I feel sure that the mortality is greatly reduced and the operation simplified.

Dr. J. Dellinger Barney (Boston): I also would like to congratulate Dr. Alcock upon his conservative and honest handling of the situation. I do feel, however, that a certain word of warning should be uttered in regard to the opening of or operating upon tuberculous kidneys until the time comes to take them out. It seems to me that from a few cases I have seen preliminary drainage of tuberculous kidneys has sometimes led to the production of miliary tuberculosis. That is not a common occurrence, but at the same time I feel that it does occur, and that occurs from the opening up of new tissue which otherwise would not be infected. So I feel that while in most cases a person with severe infection with renal tuberculosis can be brought into good condition by other methods, I think that the preliminary drainage of the kidney is a dangerous procedure.

Dr. William C. Quinby (Boston): May I discuss your paper, sir, in this regard: that I am sorry to find you somewhat, shall I say, unenthusiastic about plastic operations on the kidney. As I understood, you feel that the hydronephrosis with a large sac offers rather a poor outlook for a good result after plastic surgery. In several instances, I have resected such pelves entirely; not a partial but a complete excision of the pelvis, with re-suture and reimplantation of the ureter, with perfectly splendid results, as judged by drainage and subsequent career.

Furthermore, a re-implantation of the ureter to more advantageous position in the dilated renal pelvis, than originally found at operation, has also, in my hands, been very successful.

I agree in the main with Dr. Crosbie. I do not believe I go quite so far as he in regard to the necessity for nephrostomy in every case where the kidney has been opened. I think my

attitude is probably more in alinement with that expressed by Dr. Keyes. Certainly we all are indebted to Dr. Alcock for painting a picture with which all of us are familiar.

Dr. RICHARD F. O'NEIL (Boston): Along the line of conservative renal surgery, I have some x-ray plates of an observation on a patient which at least was of interest to me, in showing what can happen to a kidney that is left alone. This patient two years ago was having a great deal of back pressure and pain due to a calculus situated low in the ureter. The calculus was removed by operation. The pyelogram taken at that time showed, as you can see a big, dilated ureter and considerable hydronephrosis.

The patient came in this last winter, two years following the operation, with some slight pain in the right side, so I investigated the case again. The pyelogram taken at this time shows a very marked change in the ureter and the pelvis of the kidney. The former being almost normal and only a slight degree of hydronephrosis present.

I regret I have not the phenolphthalein estimation on either occasion, but there was a good stream of urine, and there is every reason to believe that that kidney has come back and is a good functioning organ.

PRESIDENT CHUTE: Dr. Hagner has a case that he has brought in and would like to show, so I am going to take the liberty of stopping the discussion for the moment and offering him the opportunity to show the case.

Dr. FRANCIS R. HAGNER: I have several of these cases and I was going to report them at this time, but I got the report in too late, so I am not going to make any extensive report and just make a very brief report of this one case.

This man came to us in December, 1922, with a very large tumor of the kidney. I will not go into the study and all that—it would take too long. We operated on him, explored the kidney. The tumor extended from under the ribs almost to the pelvic brim. We dissected around the kidney and found that the

pedicle was half again the size of my wrist and the ascending vena cava was intimately connected with this pedicle, and to remove the kidney we would have had to cut right along through the tumor tissue. We had had a case before, similar to this, and had a good result in what we did to this case.

We took a section of his kidney out for examination, and the report came back: "Small, round-cell sarcoma." We had a frozen section made at the time we operated on him, and that was later confirmed by further study of the section. He was put on massive doses of x-ray.

We are fortunate here, in having, I think, one of the most powerful machines, and Dr. Merritt at the Garfield Hospital, tells me the following: He says that these cases have had such massive doses of x-ray that the average x-ray man, would not believe it possible to subject a patient to such an intensive treatment, the total amount being 6000 milliampere minutes, and the strength of the current being 200,000 volts, with 4 milliamperes passing through the tube at 50 centimeter distance, and filtered through a one-half millimeter copper-fitter. He was treated from January 31, 1923, to September 29, 1923, and he had during that time, 6000 milliampere minutes.

When he came to us, his hemoglobin was down to 25 per cent, and his red blood cells 1,300,000. He had lost 45 pounds in weight, and he would bleed from the kidney so that we would have to evacuate his bladder with an evacuating instrument to get the clots out.

It has now been over a year and a half. He is apparently in perfect health; the tumor has disappeared, and he is apparently, I think, as well as he has ever been, according to his own statement, and his urine is perfectly clear.

I have been very anxious to make a further study of this case and catheterize the ureter and get another x-ray plate of the injected kidney. I made an engagement to do this, but the patient did not come for the examination. However, the original x-rays that we took showed 3 long projections from the pelvis, into this kidney mass. He has some induration of skin and spots from the effect of the x-ray. We have tried this in some cases of

carcinoma of the kidney and it has had absolutely no effect. I believe the reason we get results is because the sarcoma cells are the nearest form of embryonal cells that we have and are probably affected more by the x-ray than any other cells.

I have not examined this man for two months, but at that time he had no palpable tumor.

Perhaps I did not make this plain: We did not remove this kidney at all.

Dr. ARTHUR H. CROSBIE (Boston): Just a word about the case that Dr. Laurie spoke of. Of course, in opening the kidney there frequently is alarming hemorrhage, but my experience is that if a rather tight fitting tube is put through, the bleeding checks of its own accord. After introducing the tube, I always watch the kidney for some little time, and if it still oozes, I put a deep catgut suture on each side, or else pack gauze down at the side of it. I think if that is done, the bleeding will always stop.

Dr. NATHANIEL G. ALCOCK (closing): I am in complete agreement with Dr. Barney in regard to the danger of producing acute miliary tuberculosis when draining tuberculous kidneys. That very thing happened to me in 1 case. In another case of the bilateral type an acute miliary infection developed immediately following a cystoscopy.

PROBLEMS IN THE TREATMENT OF MULTIPLE RENAL LITHIASIS

WILLIAM F. BRAASCH

Rochester, Minnesota

The indications for operation in the presence of multiple stones are not standardized and the procedure is largely a matter of clinical judgment. The tendency in recent years has been toward conservative treatment of multiple renal lithiasis. Where the destruction of the kidney for complete removal of stones is not too great, and where it is evident that considerable renal functions remains, the kidney should be saved. It may be comparatively easy to remove the kidneys for stones, but it requires experience and the cooperation of several technical aids to remove all stones successfully and save the kidney. Among the factors which must be considered in determining the advisability of conservative operation are included, size and shape of stone, number present, are involved, renal function, degree of infection, age of the patient etc.

SIZE AND SHAPE OF STONE

It must be recognized that the removal of certain types of stones may necessitate considerable destruction of renal tissue. This is not dependent so much on the size as it is on the shape and position of the stones. A round, smooth stone, even though of considerable size, is much more easily removed than a branched or coraliform stone filling the pelvis and calices. The destruction of kidney tissue is much less in removing the former than it is in the latter. Small stones, even though situated in different portions of the kidney, can usually be removed with the aid of renal fluoroscopy without a great loss of renal function. It is only recently that we observed a case of this type where seven stones were removed from the kidney and a subsequent estimate

of the renal function made a month after operation showed the dye return to be practically normal and equal to the function prior to operation.

DIFFERENTIAL RENAL FUNCTION

The comparative estimation of function of either kidney may be a factor in determining the type of operation, especially with bilateral nephrolithiasis. Intravenous injections with indigocarmin offer the simplest methods at our disposal. The intensity of the color of the urine from either ureteral orifice gives a rough but fair index of renal function. The differential phthalein test is more accurate in determining the degree of reduction in function but is subject to technical error. With a normal functional estimate, a conservative operation is indicated if otherwise possible; if there is no dye return, a nephrectomy is usually necessary, although not always. Intermediate values are inaccurate, because of reflex irritation caused by the presence of stone and have but little clinical value.

AGE

The patient's age may be a factor in determining the operative procedure, particularly in unilateral conditions. A nephrectomy may be advisable in an older adult, although with similar conditions in a young adult a conservative operation might be tried. With stones in both kidneys, when the function of the kidneys is about equal, every effort should be made to preserve renal tissue when possible, and in many cases conservative operations are attempted which would probably not be done had the condition been unilateral.

There is no diagnostic method which will always enable one to determine the exact number of stones present, even though a shadow may be identified as intra-renal. It is now generally recognized: (1) that although one shadow may be present in the roentgenogram, there may be several overlapping or adjacent stones to cause it; (2) although there may be multiple shadows in the roentgenogram, there may be but one stone

present in the kidney; (3) that the number of stones discovered at operation is found to differ from the number of shadows in the roentgenogram. Thus, in a review of our record made from 1026 patients operated for renal stone, we have the following interesting data: (1) a single shadow was reported in the roentgenogram and multiple stones were found at operation in 146 cases; (2) multiple shadows were reported in the roentgenogram and a single stone found at operation in 66 cases; (3) the absence of shadows was reported in the roentgenogram and one or more stones found at operation in 21 cases, and (4) shadows were reported to be in the upper ureter, but at operation stones were found in the kidney, not in the ureter, in 5 cases.

During the last five years we have employed renal fluoroscopy at the operating table in over 200 cases and have found it to be of the greatest importance in the successful removal of multiple renal stones. In fact, the question might well be voiced whether a conservative operation for multiple renal stones should be attempted without its use.

It is claimed by those who have not had adequate experience with the method that it is often a failure in that it does not reveal all the stones. This may occasionally be true of minute fragments, one or two millimeters in diameter. Nevertheless, even though fragments of this size are allowed to remain, in the majority of cases they will pass spontaneously. One of the objections to renal fluoroscopy might be that it placed the surgeon in an awkward position when a small stone is discovered in the end of a calix or in the parenchyma which the surgeon, in spite of skill and patience, is unable to find. As a result, considerable mutilation of the kidney may be necessary before the small stone is found and removed. Another objection may be raised from the fact that the exact location of a small stone by the fluoroscope may be extremely difficult. It is true that it is frequently hard to estimate the relative depth of the site of the stone, but this may be greatly aided by inserting needles at right angles, under the guidance of the fluoroscope, so that the points of the two needles will approximate at the site of the stone. There is no method of diagnosis that is infallible, but in a review of several

hundred cases of renal lithiasis where renal fluoroscopy was employed, we have found the existence of minute shadows remaining in post-operative roentgenograms in but 5 patients or less than 3 per cent, and in several cases these shadows were of a doubtful nature.

PROTOCOLS

Case 1. Multiple stones in one kidney and stone in lower ureter on the same side. A-374358. Man, aged thirty-two.

History of repeated colic referred to the left side over a period of several years.

Physical examination. Negative.

Urinalysis. Thirty-five pus cells to the field.

Renal functional tests. Normal.

Roentgen ray. Large branched stone or possibly multiple stones, in left kidney area, also two stones in region of lower left ureter, larger 1.5 x 1 cm. smaller 1 x 1 cm.

Cystoscopy. Function of left kidney markedly reduced, with impassable obstruction to catheter at uretero-pelvic juncture. Right kidney normal.

Operation. First, left ureterolithotomy, with removal of two stones as described. Second, three weeks later, left pelviolithotomy, with removal of branched stone and several portions, possibly small stones.

In the presence of stones in the kidney and ureter on the same side it is usually advisable to remove the stones from the ureter before operating on the kidney otherwise obstruction of the ureter may result in a persistent renal fistula.

Case 2. Stone in kidney and migratory stone in ureter of same side. A-187578. Female, aged thirty-six.

History of pain along course of right ureter for three years.

Physical examination. Negative.

Urinalysis. Few pus cells to a field.

Roentgen ray. Stone (1 cm. in diameter) in right kidney area and one (1.5 cm. in diameter) in right ureter at level of third sacral.

Unsuccessful attempts were made to remove the ureteral stone by manipulation. It was then decided to displace the stone in the ureter by means of a ureteral catheter into the upper portion of the ureter, so both stones could be removed through the kidney incision. This was done just before the patient was operated. A pelviolithotomy was then

performed, removing both stones. The patient was saved the ordeal of a second operation by this simple manoeuver.

Case 3. Stone in kidney with pyonephrosis and stone in lower ureter indicating nephro-ureterectomy. A-479143. Man, aged twenty-two.

History of recent pain in the left side with pyuria and hematuria.

Physical examination. Revealed tenderness over the right kidney.

Functional tests. Forty-five per cent.

Urinalysis. Large quantities of blood and pus.

Cystoscopy. Evidence of marked destruction of function of the left kidney.

Roentgen ray. (1) Multiple scattered branched stones in left kidney. (2) Multiple large stones in lower left ureter.

Operation. Left nephro-ureterectomy. First, anterior incision, freeing the lower end of the ureter and ligating; later, lateral incision, with nephrectomy drawing the ureter out with the kidney.

With multiple stones in the ureter it is usually advisable to remove by uretero-lithotomy, rather than by manipulation.

Case 4. Multiple stones in one kidney and stone in lower ureter on other side. A-469015. Man, aged thirty-two.

History of pain in right lumbar area with anterior radiation; recent acute attacks.

Physical examination. Negative.

Urinalysis. Fifty pus cells to a field.

Roentgen ray. Stone right ureter 1.5 x 1 cm., together with phleboliths; two, possibly three, stones in the left kidney, larger 2 x 2 cm.

Cystoscopy. Function of both sides equal.

Unsuccessful attempt made to remove the stone from the right ureter by manipulation. Right uretero-lithotomy and two weeks later left pelviolithotomy.

It is always advisable to remove ureteral stones before kidney stones as they are the cause of more acute pains as a rule and then, too, they may completely obstruct the ureter while the patient is convalescing.

Case 5. Massive bilateral nephrolithiasis—symptomless and inoperable. A-458853. Man, aged twenty.

History of a slight dull ache on the right side for the past six months. There were no urinary symptoms.

Physical examination. Negative.

Urinalysis. Forty pus cells to the field.

Roentgen ray. Massive multiple stones both kidneys; single stone in bladder.

Functional tests. Phthalein 35 per cent blood urea 38 mgm. per 100 cc.

Cystoscopy. Bilateral nephrolithiasis. Right—huge, branched stone and several smaller stones, filling dilated pelvis. Left—branched stone filling calices. Function of both kidneys fair and equal,—indigocarmin deep blue from both sides.

Bladder stone (4 x 3) removed by litholapaxy.

The kidney destruction which would result from the removal of stones of this size contraindicate surgery unless the symptoms are so severe that life is practically unbearable for the patient. Under these conditions, surgery is perhaps justified.

Case 6. Bilateral stones. Multiple in one kidney with one stone small enough to pass. A-189537. Man, aged 43. Adipose patient.

History of repeated colic in both kidney areas, more recently in right.

Physical examination. Negative except for slight tenderness over right kidney.

Urinalysis. 32 pus cells to the field.

Functional tests. Phthalein 20 per cent, blood urea 64 mgm.

Roentgen ray. Showed one large and one small shadow in right kidney area and medium size shadow in left.

While patient was kept under observation and was cystoscoped, the smaller stone in the right kidney passed to the lower ureter. Attempt at manipulation was followed by acute pyelonephritis with alarming symptoms, and it was necessary to do a uretero-lithotomy.

With multiple stones (2 or 3) in renal pelvis, there should not be unnecessary delay before operating, because of the danger of one of the stones passing into the lower ureter, which, if it cannot be removed by manipulation, necessitates an extra operation for the patient.

Case 7. Bilateral nephrolithiasis. A-453611. (Illustrating age as a factor in determining operation.) Man, aged sixty-two.

History of dull pain in left lumbar area at intervals for four years. Similar dull pain in right flank on several occasions during past years.

Physical examination. Negative.

Urinalysis. Twenty pus cells per field.

Functional tests. Phthalein 10 per cent blood urea 58 mgm.

Roentgen ray. Bilateral nephrolithiasis. Multiple large round stones in both kidneys. Left, multiple stones, largest 5 x 5 cm. with many small stones. Right, multiple stones apparently soft, largest 4 x 5 cm., multiple small stones.

Cystoscopy. Comparative function of both kidneys markedly reduced; left somewhat better than right. It was thought inadvisable to operate this patient because of the lack of acute symptoms and his age. If this patient had been thirty years younger, operation would have been indicated.

Case 8. Bilateral nephrolithiasis with one kidney practically functionless, the other being normal. A-451902. Man, aged twenty-five.

History of attacks of severe pain in either kidney since seven years of age; recent pain in right side.

Physical examination. Revealed tenderness over both kidneys.

Functional tests. Phthalein 45 per cent.

Roentgen ray. Left, huge branched stone and multiple smaller stones. Right, two stones 1½ x 1 cm. Outline of hypertrophied kidney.

Cystoscopy. Right, function normal; left, but little function remaining.

Operation. Right pelviolithotomy, followed by left nephrectomy.

In such a case it was thought best to operate the better functioning kidney first so as to take advantage of the small, remaining functions of the poorer kidney. Then as after the patient convalesced and the function of the better kidney returned to normal, the poorer kidney was removed.

Case 9. Bilateral operable nephrolithiasis. A-452056. Female, aged forty-seven. Type favorable for bilateral operation.

History of repeated attacks of colic referable to the left kidney area, and occasional dull pain on the right.

Physical examination. Negative.

Functional tests. Phthalein 45 per cent, blood urea 26 mgm.

Roentgen ray. Showed multiple stones in the right kidney area, and one or more stones in the left kidney; also stone 2 cm. in diameter in left lower ureter.

Cystoscopic examination. Showed, with indigocarmin, the function of both kidneys; right 3, left 2 on a scale of 4. A stone was seen partially protruding from the left ureteral orifice, which was cut and stone subsequently passed.

Operation. Right pelviolithotomy; single stag-horn stone removed

from kidney, together with much sandy material. Subsequent operation: left pelviolithotomy, one stone 2 x 2 cm. and a number of small stones, together with sandy material removed.

Two months after last operation renal function normal and equal. Subsequent roentgen rays were negative. It was deemed advisable to operate the right kidney first because of the better function existing in it and because the pain was practically the same on both sides except during colics which were more severe on the left.

Case 10. Multiple small stones in one kidney and single small stone in the other. A-475428. Female, aged forty-five.

History of intermittent colic during period of two and one-half years, always in the right side, with pyuria, chills and fever. Passed several small stones during these attacks. No symptoms referable to left kidney.

Physical examination. Negative.

Cystoscopy. Bilateral nephrolithiasis. Right kidney, multiple scattered stones varying in size from 0.5 to 1 cm. Function normal. Left kidney, single stone 1 cm. in diameter in pelvis. Function normal.

Operation. Combined nephropelviolithotomy, five cortical stones were removed. Fluoroscopic examination at the operation table showed the kidney free from stones. This was corroborated by a postoperative ray.

Cystoscopic examination with estimation of the function of the right kidney one month after operation showed the function to be normal. It was thought advisable in this case to remove the stones only from the right side because the stone in the left side was single, painless and small enough to pass.

Case 11. Multiple bilateral stones with pain. A-467303. Man, aged eighteen. Typifies multiple bilateral stones where conservative operation is necessary and indicated in both kidneys.

History of passing stones and sand at intervals since eight months of age. Always had pain in the left side; never in the right. Recent acute pain and tenderness left flank.

Urinalysis. Pus in large quantities. Cloudy for years.

Functional test. Phthalein 15 per cent in two hours. Blood urea, 52 mgm.

Physical examination. Negative save for acute tenderness over left lumbar area.

At *operation* eight stones removed from left kidney by combined nephropelviolithotomy. Kidney found to be three times normal size and containing a great deal of pus. Although fluoroscopic examination showed two shadows remaining in the kidney, because of marked destruction of kidney substance, and the condition of the patient, it was considered advisable not to carry on the search any longer. Subsequently, a right nephropelviolithotomy was done, with twelve stones removed.

Case 12. Bilateral recurring nephrolithiasis (left over stones). A-471925. Man, aged twenty-three.

History of bilateral pelviolithotomy elsewhere two years ago. Since operations has had marked pyuria and hematuria most of the time.

Physical examination. Revealed tenderness over both kidneys.

Functional test. Phthalein 40 per cent.

Roentgen ray. Soft, irregular, multiple oblong stones in either kidney with a large amount of sandy material.

Operation. Right pelviolithotomy done with considerable difficulty. It was impossible to deliver the kidney for fluoroscopy. Wide destruction of kidney was necessary for removal of the stones. A conservative operation necessary where radical operation would have been made if the condition had been unilateral. Fluoroscopy with the kidney partially elevated showed fragments which could not have been discovered otherwise. The postoperative course was very stormy.

Postoperative ray of right kidney negative.

Immediate operation was not felt advisable on left kidney because of patient's general condition. The technical difficulties which attend a secondary pelviolithotomy are by no means negligible. Stones which could be easily removed at a primary operation may be impossible to remove at the second. The exposure of the kidney and the hemorrhage resulting from attempts at getting exposure are the two main difficulties encouraged in this type of case.

Case 13. Bilateral large ureteral ssones. A-422759. Man, aged twenty-eight.

History of dull pain referred to both kidney areas for many years, together with pyuria and intermittent spells of fever.

Physical examination. Revealed cachexia and anemia.

Urinalysis. A great deal of pus.

Functional test. Phthalein 15 per cent.

Roentgen ray. Two huge stones 5 x 6 cm. in bladder area, which might be either in diverticula or in the ureter.

On *cystoscopic examination* several bladder diverticula found. Impossible to determine whether stones in ureter or in diverticula with cystogram, which was made. Shows outline of stones extending beyond bladder outline, identifying them as intraureteral. Further corroborated by passage of lead catheter.

Bilateral uretero-lithotomy at operation.

CONCLUSIONS

1. Renal fluoroscopy is a great aid for rational, surgical operations for renal lithiasis.

2. Bilateral recurring stones present serious technical difficulties at operation, chiefly by the fact that exposure is so difficult and hemorrhage.

3. Where a small, single stone exists in one kidney with multiple stones in the other, it is advisable to remove the multiple stones and watch the small single stone for some time before removing it as it may pass spontaneously.

4. Where multiple small stones exist, delay in surgical removal should be avoided because of the danger of one passsing into the ureter causing obstruction, and further impairment of the already reduced renal function and necessitating an emergency operation.

5. Where bilateral renal stones exist and one kidney is practically functionless, it is advisable to remove the stones from the better kidney first, and later perform a nephrectomy on the functionless side.

6. Where renal lithiasis exist with stones in the ureter on the same side with pyonephrosis, nephro-ureterectomy is indicated.

7. Where renal lithiasis exists with stone in the ureter of the same side with fair or good renal function, ureterolithotomy should be done first.

8. Where renal lithiasis exists with stone in the ureter on the other side, uretero-lithotomy should be done first if manipulation is unsuccessful.

9. Where renal lithiasis exists with a migratory stone in the

ureter of the same side, an attempt to push the ureteral stone into the kidney should be made before operation.

10. Where multiple ureteral stones exist, it is inadvisable to place the patient in the Trendelenburg position and the small stones should be searched for first.

11. Age and shape of stone may be a factor in determining operability.

BILATERAL RENAL LITHIASIS

GILBERT J. THOMAS

Minneapolis, Minnesota

Received for publication June 15. 1925

Bilateral renal lithiasis is not a rare condition. I find, after consulting my records of adults, that 12 per cent of renal stones occur in both kidneys. During 1921 I studied data concerning urinary stones in 203 children and infants and found renal stones bilateral in 6 per cent. The data reported in this paper was obtained from a review of histories, findings, operative results and follow-up records of 17 patients with this condition. Sixty-six per cent of bilateral stones are multiple and occur in kidneys chronically infected and commonly called "stone formers." I find the proportion of male to female 5 to 1. The average age is forty-three years. Sixty-six per cent of patients had no symptoms referable to the kidneys. Thirty per cent of the number studied were operated on without relief, that is, the stones recurred. Patients relieved following operation had single small stones which were free in the renal pelvis or at the uretero-pelvic juncture. In these instances, little or no infection was found in the kidneys. In few instances did the removal of foci of infection, together with pelvic lavage, permanently control the infection in the pelvis or the kidney. Temporarily the infection might be controlled but recurrence with formation of more stones was the rule.

My interest in renal stones in children was revived one year ago when a physician brought to me for urological examination, a baby of sixteen months. The history revealed that this infant when six months of age had an illness which was thought to be pyelitis. At this time there was temperature of 105° with pyuria,

the child being very ill. After a few weeks the baby's temperature became normal but the pyuria continued. Following the first attack, the patient had occasional remissions wherein the temperature and pyuria would increase. About four months before I saw this baby, it had a very severe head infection which began in the throat and involved both middle ears. Following this, the adenoids were removed.

FIG. 1

When brought to my office, the baby had a very slight temperature but the urine contained a quantity of pus. Roentgen-ray examination revealed multiple large shadows over both renal areas (see photograph, fig. 1). Because of the size of the shadows and the possibility that they might not be caused by renal stones, cystoscopy was advised. I found a normal bladder with a normal quantity of cloudy urine spurting from each meatus.

The function of each kidney seemed to be equal and good, but indigo-carmine was somewhat delayed from both sides. At this time, the child was free from pain and as its general condi-

FIG. 2

tion was good, and no stones were found in the ureter, I advised that no surgery be attempted unless an emergency arose.

During last summer, the family moved to Toronto, Canada where the baby was treated by Dr. James C. McClelland for

acute suppression of urine. A roentgen-ray examination at this time revealed several shadows over both renal areas and one over the lower end of the left ureter. The ureteral stone, together with those found in the renal pelvis, a total of fourteen, were removed through left nephrotomy and ureterotomy incisions.

The patient improved considerably after this operation so that two months later, six stones were removed from the pelvis of the right kidney. At this time a stricture of the right ureter was found about one centimeter below the uretero-pelvic juncture which required a plastic operation for relief. Recovery from the second operation was uneventful. However, roentgenograms made just before the second operation revealed the presence of two stones remaining in the left or in the first operated kidney. A roentgenogram taken April 9, 1925, about ten months after the last operation, reveals shadows over both renal areas (see fig. 2). At this time the child was in fair physical condition, but the urine contained a large quantity of pus. Culture of the bladder urine revealed what at first was thought to be a pure culture of streptococcus. We were unable to recover this organism after intravenous injection into an animal.

Calculi in infants are frequently overlooked because cystoscopy and roentgenography are not done. Most physicians are prone to make a diagnosis of pyelitis in every infant or child that has pus in the urine. In the examination of this child, renal stone would have been overlooked if a roentgenogram had not been made. It has been my practice for many years to insist on a clear roentgenogram of both kidneys, both ureters and bladder in every patient who submits to urological study.

The second unusual case history which I wish to report in detail concerns a man of sixty-six years of age. This man's past history was negative except that he passed a renal calculus about twenty years before the onset of the present trouble. He had always been well except for an occasional cold.

The present trouble began one month before the patient was seen by me. At this time he began to urinate two or three times at night and four to five times during the day, which had not been his usual custom. There was no difficulty in passing

urine or starting the stream. There was no dribbling following urination.

One week following this onset, the patient noticed blood in the urine. This was present every day, but not every urination. A few times he passed bright red blood.

Physical examination revealed an old man with tortuous vessels which were somewhat thickened. Blood pressure 155/85. The aorta was slightly arterio-sclerotic and lengthened. This patient requested a cystoscopic examination to determine the cause

FIG. 3

of his hematuria. When roentgenography was suggested, it was at first refused as unnecessary. After much explanation, the patient submitted. This examination revealed large multiple coral stones in both kidney pelves (see fig. 3). Again the patient refused further examination, suggesting that since the roentgen-ray had revealed the cause of his trouble, further study was unnecessary. However, I wished to complete my study, so after two or three days delay, the patient consented to cystoscopy. When the cystoscope was introduced into the bladder I was very glad that I had insisted on a thorough complete urologic study.

The bladder contained nine tumors, varying in size from a green pea to an English walnut, some having small pedicles while others were low-lying with infiltration of the bladder mucosa. Turbid urine could be seen spurting from both meati. Catheters were introduced into both renal pelves. Indigo-carmine returned in ten minutes from the right side and was delayed to twenty-five minutes from the left. An ureterogram with a shadow casting catheter was made and this eliminated small shadows which were thought to be stones in the lower ureter. A palliative operation was advised and diathermy was applied to all the bladder tumors. The operation was done with caudal anaesthesia and suprapubic infiltration. About three weeks following operation, the patient began to show signs of approaching uremia. He eventually returned to his home and although he was slowly improving, his condition was never good. The patient died very suddenly four months following operation, probably a cardiac death. Autopsy was not obtainable. Before this patient was operated, his blood chemistry was normal.

The review of my cases of bilateral renal lithiasis reveals that in no instance, except where very small single stones were present, have I advised surgery. Recurrence has been the rule in each instance. When possible, foci of infection have been removed and boiled water has been used by the patient. We have constantly attempted to make satisfactory bacteriological studies from the urine but without success. This work will be continued because I feel that a particular type of streptococcus is carried to the kidney by the blood stream. This infection remains in the kidney where precipitation of salts from the urine on a bacterial nucleus or on a nucleus composed of debris the result of infection produces small recurrent stones. I have been unable to obtain satisfactory cultures of streptococci from infected teeth because distinct foci have not been isolated as a rule. I will continue to search for a bacteriological cause of recurring renal stones because this condition affords an unusual opportunity for urologists to study this phenomenon.

I feel that a complete diagnosis of the cases herein reported was only possible after thorough routine urological examination. If

either cystoscopy or roentgenography had been omitted, the diagnosis would have been missed.

Conclusions should not be drawn from a study of data from a small number of cases. However, I feel that this data, together with the reports, teach the following:

1. In infants and children 6 per cent of renal stones are bilateral.
2. In adults 12 per cent of renal stones are bilateral.
3. Bilateral renal stones are multiple in 66 per cent.
4. Large stones may be present in both kidney pelves without producing symptoms.
5. Renal stones which may be silent in one or both kidneys should be thought of in all infants or children who have pus in the urine.
6. A complete urologic study should be made of infants and children having pus in the urine. This must include a roentgenogram of the entire urinary tract.
7. Bilateral renal stones, when multiple or when large, are rarely surgical unless an emergency exists. Multiple recurrence is the rule.

DISCUSSION

Dr. Hugh Cabot (Ann Arbor): I want to discuss just for a moment, Dr. Braasch's paper. I find myself very much in agreement with him in regard to his work. There are two points, however, in which I do not find myself quite in agreement. One is in regard to his suggestion that nephroureterectomy is the operation indicated in these cases of stone in the kidney and ureter. If he were particularly to address himself to those cases of rather large stone in the ureter, my experience has been that it is possible in the great majority of cases to remove the stone in the ureter without removing the ureter. They are generally cases of relatively large ureter in which the stone can be drawn back.

I think particularly it is wise to suggest to the general surgeon who will continue undoubtedly to operate in a large number, if not a large proportion of these cases, that he do the least operation which is compatible with removal of the condition.

I agree that the stones in the ureter should be dealt with, but I think that in the majority of cases with these stones, that have come under my observation, it has been possible to remove the stone without removing the ureter, and it is a distinctly lesser operation. Often I think the operation for removal of the ureter is carried out through a very large—I think unnecessarily large—incision, and not by the method which Dr. Braasch suggests. But I believe it is wise always to consider the possibility of removing these stones without removing the ureter. I think the ureter itself is unobjectionable except for the presence of stones, and if the stones can be removed, there is no object in removing the ureter.

I am particularly interested in the suggestion that in cases of multiple calculi, the leaving of a small portion of stones is unobjectionable. Evidently he has had access to a more favorable

group of cases than I have, because in my hands, the leaving of these fragments has been with great certainty followed by continued growth, and ultimately a considerable stone has formed. This group of mutiple stones has not, in my experience, been a class in which the stones failed to show their cussed tendency to grow. They have generally grown very happily—I mean happily for the stones, not for the patient—and I am doubtful whether as a rule stones left in that way can be safely assumed to remain dormant.

I quite recognize the very grave difficulty of removing all stones. I think by the methods which Dr. Braasch applies here, that a great advance has been made in the certainty of removing all the stones, but even then some will be left, and I have always felt it was a very considerable menace to the patient.

Dr. George R. Livermore (Memphis): Something was said about the migration of stones, I have had a case that rather forcibly demonstrated how far a stone can migrate in a patient. This patient had quite a large stone, down almost at the ureterobladder junction. It was a large oval stone, we made an opening along the lower ureter and had the stone between two fingers. In manipulating it, the stone slipped from my finger and felt as though it went upward, but I traced the ureter up as far as I could reach, and could not feel any sign of the stone at all. We then opened the ureter, and passed a catheter up, and we could feel no obstruction whatsoever, passing the catheter very gently, so that if I hit any obstruction, I could feel the stone with the tip of the catheter, and the catheter passed on upward for a distance of 6 or 8 inches.

I then called in the x-ray man to take a picture of the patient, to locate whether this stone might have slipped into the bladder, or whether it had passed upward, and the x-ray picture showed this stone lying in the pelvis of the kidney.

I then made an incision, in the loin, and removed the stone from the pelvis of the kidney. I had never seen a stone migrate to that extent, and particularly when, during operation, you have had the stone in your fingers. I have seen one slip 1 or 2 inches,

or 2 or 3 inches, but I have never seen a stone go all the way to the pelvis of the kidney, with the patient lying perfectly prone.

Dr. J. Dellinger Barney (Boston): In connection with the cases of urinary calculi reported by Dr. Thomas, I would like to make brief mention of a case I saw some years ago in a boy of about eight or ten years of age. He came in with his mother, bringing with him a quart preserve jar nearly full of small stones, which the mother said he had passed from the age of about three months up to the present time. Every little while he would pass a stone or two.

X-ray showed both kidneys filled with multiple calculi, undoubtedly stones of rather small size, and in the lower end of the right ureter there were three packed together. The boy's condition was extremely good and his urine but slightly turbid.

I did not feel that operation should be done, so in December I consulted Professor Folin, Professor of Biochemistry at the Harvard Medical School, and asked for suggestions. The chemistry of these stones showed calcium oxalate, practically alone. Professor Folin said the source of calcium was largely from milk and milk products. He said, "Why not cut out all milk? You cannot cut out the oxalate, but you can cut out the calcium."

So the boy was put on a diet which was entirely free from all milk in any form, cooked or otherwise, and I followed the boy by x-rays and otherwise at intervals for about two years. The boy kept on passing stones, as he had before, but an x-ray at the end of about eighteen months after I saw him, showed that the three shadows in the right ureter had disappeared and that the number of shadows in the kidneys was very much reduced. Unfortunately, after two and one-half years, the boy died of pneumonia. I do not know what the outcome would have been, but it certainly is suggestive as a means of relieving stones composed of calcium oxalate in children.

Dr. William C. Quinby (Boston): We are indebted, I know you all agree, to Dr. Braasch for summarizing this problem, and I agree with his deductions, having experienced a good many similar cases, except in regard to leaving stones. I feel very

strongly that if it is humanly possible to rid a kidney of stones, such effort should be made; and doubtless in your Clinic effort has been made by washing, as well as by other manipulations. You did not mention them.

I merely want to mention the fact that a great deal of aid sometimes is gained from a forcible, small current of saline or sterile water directed into the various portions of the kidney while it is under investigation for clearance of stone;—then subsequent examination by x-ray; keeping it up until you get the organ absolutely clear.

Concerning the question as to operation at all, I feel that operation is much more imperative in cases showing infection than in those which are otherwise normal, except for the presence of a stone; that is, a stone in a kidney otherwise normal will not increase nearly so fast, in my experience, nor do so much damage, as if infection be present. I think I rather tend to make the presence of infection a definite reason for operative treatment in a case in which one otherwise would say, "Well, let us wait and see what happens; there is no reason for operating now."

I want to mention to Dr. Livermore an experience which I reported to the New England Branch last winter, concerning a similar case to yours, in which, through inadvertence, operation was made on the lower end of the ureter for a stone, not recognizing the fact that the stone was a migratory one. The fault lay in not having a very recent x-ray film of the patient. At operation it was found that there was no stone in that region of ureter which was exposed. By compressing the ureter, however, thus allowing urine to accumulate in the pelvis, and then suddenly letting it out at the end of a few moments, the stone was washed down from above into the operative field.

Dr. Edward L. Keyes (New York): One may look for migratory ureteral stones under two conditions:

1. When the stone is round.

2. When there is more than one stone in the ureter, the upper stone or stones may be migratory, the lower stone being the only fixed one.

Dr. ANDREW J. CROWELL (Charlotte, N. C.): On account of the great tendency of stone recurrence, I wish to call the attention of the members of the Society to the fact that recurrence is certain in cases of cystinuria, unless preventive measures are taken. Nothing has been said about this condition, I believe, in any of these papers.

We have found 5 or 6 cases of this condition in our practice and I believe it is more common that we suspect. Cystin in crystal and in solution should be sought in every case of lithiasis. If it is present, recurrence is certain unless preventative measures,—such as restriction of diet and keeping the urine strongly alkaline,—are instituted following mephrolithiasis.

PRESIDENT CHUTE: Is there any further discussion? If not, I will ask Dr. Braasch if he will close.

Dr. WILLIAM F. BRAASCH (closing): I think a just criticism of my paper might be put in terms of literary parlance, that I tried to compress the material of a novel into a short story, and as a result I dare say that many of the points I did not make as clear as I might have.

It certainly was farthest from my thoughts to infer that we should always deliberately overlook small stones and leave them remaining in the kidney. There are only rare, exceptional instances where this is permissible and I cited as an illustration a case with stones in both kidneys, where an attempt had been made to remove all the stones, but fluoroscopy showed there were two small stones still remaining. A further attempt to remove them would have destroyed that kidney, and the patient needed whatever kidney remained. Only under such circumstances would one be justified in leaving stones in the kidney.

The measures suggested by Dr. Quinby and myself during recent years to ensure the removal of all stones from the kidney should emphasize this very point. Although in the great majority of cases where any stones are left in the kidney, they will grow and eventually destroy the kidney, nevertheless it is surprising how occasionally when small stones are left in the renal cortex or in the calices they will do little harm in some cases.

THE OPERATIVE APPROACH FOR MALIGNANT TUMORS OF THE KIDNEY

HUGH CABOT

Ann Arbor, Michigan

Received for publication June 15, 1925

It will be best at the outset to state the requirements of a thoroughly satisfactory approach to this surgical problem. Generally speaking, they are of two kinds.

1. The incision or incisions must give free access and handicap the surgeon as little as is compatible with a decent respect for anatomical structures. In the case of this problem the incision must give free access to the kidney. It must also allow a wide exposure of the peri-renal structures because in many, if not most, of the cases something more than the kidney itself will require to be dealt with. Furthermore, it must give unusually free access to the pedicle since particularly in the case of the tumors of the Grawitz type, the renal vein becomes a structure of particular interest inasmuch as portions of the tumor not rarely project into it and may require removal if any large probability of success is to obtain.

2. As a somewhat secondary requirement, it is clearly the business of the surgeon to do his work with as little damage of a permanent nature as possible. We have come to recognize that damage to the nerve supply, particularly in the case of operations involving devision of the abdominal wall, is to be avoided if possible. Division of muscular structures, though it often looks serious and gives the impression of radicalism, is not so in fact. Muscular structures unite with fibrous tissue giving a scar of very satisfactory firmness and doing very little damage to the general integrity of the abdominal wall. It thus appears that

we may briefly state the requirements as being, free access and avoidance of damage to important nerve trunks.

METHODS OF APPROACH

1. The classical oblique incision commonly used in kidney surgery (fig. 1).

This incision ordinarily begins at about the anterior border of the erector group of lumbar muscles and extends forward and downward just below and in general parallel with the twelfth rib. It is possible to extend this incision forward and inward to

FIG. 1

FIG. 2

almost any extent. This incision avoids damage to large nerve trunks and has been eminently satisfactory for a large majority of the problems presented in renal surgery. In the case of renal tumors, however, it does not appear to me to give quite satisfactory access to the tumor. In many of these cases the mass is situated relatively high under the diaphragm. It is necessary to remove not only the kidney itself but also its fat capsule, a requirement which does not obtain in other operations on the kidney. The most important defect of this incision, however, appears to lie in the relatively poor access that it gives to the renal

pedicle. A review of the literature particularly in regard to the mortality in operations for tumor of the kidney seems to show that the largest factor in this mortality is bleeding. Inability satisfactorily to control bleeding is likely to result from a cramped approach and in this case I believe that the common use of this incision is an important factor in the still too high mortality in this group of cases.

2. The anterior oblique incision (fig. 2).

This incision starts relatively further forward than the classical kidney incision and is continued downward and inward from

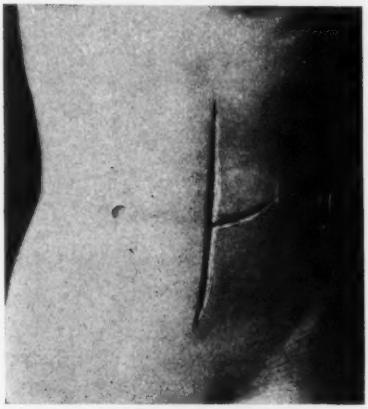

FIG. 3

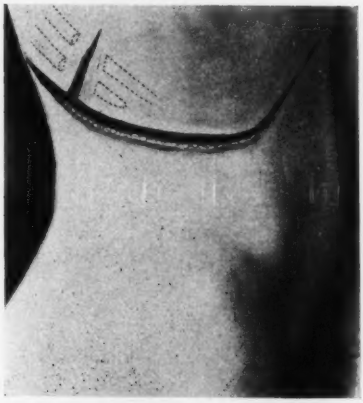

FIG. 4

a point in about the mid-axillary line parallel with the direction of the fibres of the external oblique. It is satisfactory from the point of view of moderate damage to structure and avoidance of the most important nerve trunks. It appears to me, however, to suffer from the same objection as that affecting the other oblique incision; namely, that it gives relatively poor access to the tumor mass. It may also do damage to nerve structures if it is made of thoroughly sufficient length. The nerve supply of the rectus muscle turns sharply inward and is likely to be divided with the effect of producing more or less paralysis of this structure.

3. The vertical incision through or at the outer border of the

rectus muscle combined with a transverse incision about the level of the umbilicus (fig. 3).

This incision will probably give satisfactory access but it seems to me very undesirable on account of the inevitable and con-

FIG. 5

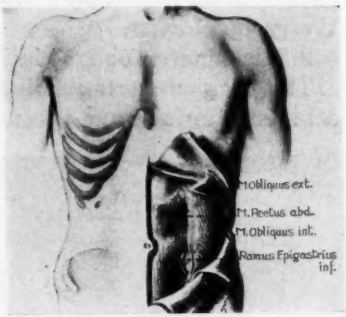

FIG. 6

FIG. 7

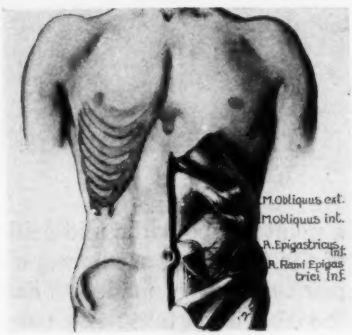

FIG. 8

siderable damage to the nerve supply of the rectus. If made of sufficient length to give thoroughly good access, it will be likely to paralyze the greater part of the rectus muscle. The transverse portion of this incision is largely free from objection but its vertical limb is highly damaging.

4. The high transverse incision with cross-cutting of the eleventh and occasionally the tenth rib (fig. 4).

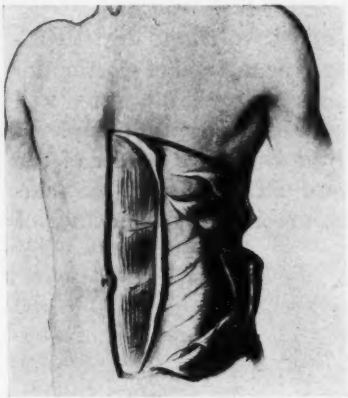

FIG. 9

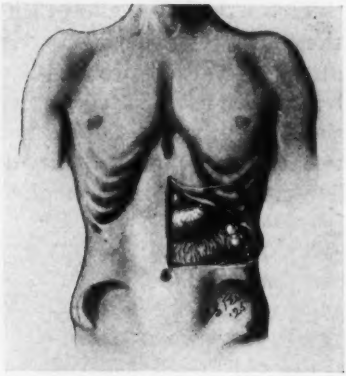

FIG. 10

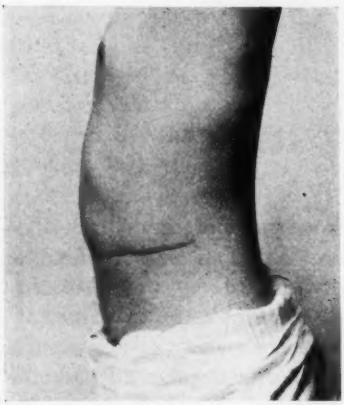

FIG. 11

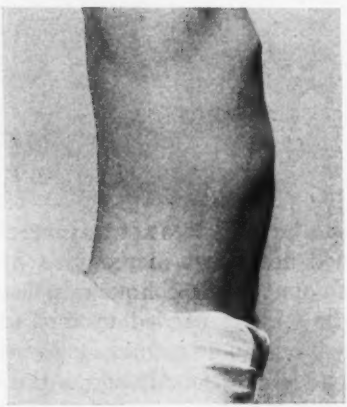

FIG. 12

This incision is probably rarely used. The transverse portion of it is largely free from objection but the vertical portion might do damage to nerve structures particularly the eleventh intercos-

tal if it were made in such a way as to give really good access to that portion of the tumor which lies under the diaphragm.

5. The transverse incision combined with a vertical midline incision.

This is the incision to which I desire particularly to draw attention since we have come to regard it as the method of election for attack upon these problems. The incision should be started well back in the loin near the anterior border of the erector group. It should be planned to pass not far from the lower border of the twelfth rib, inclining slightly downward until it reaches the midline of the body in the region of the umbilicus. The course of

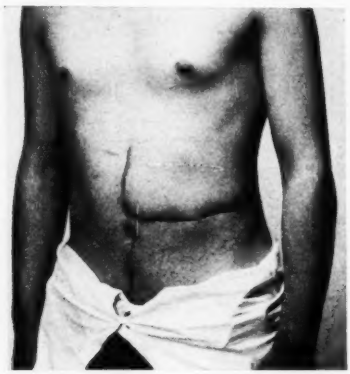

FIG. 13

this incision does not traverse any nerve trunks of importance and will not result in paralysis of the rectus or of any important amount of the oblique muscles. It is then met by an incision in the midline carried upward to any necessary extent. This, of course, can do no damage to nerve supply or to any other important structure. It allows the raising of a triangular flap which gives direct access to all of the structures of the upper quadrant. Through this incision the costal margin may be lifted as freely as is ordinarily necessary. The peritoneum is lifted from the posterior wall, carrying with it the colon and its mesentery which may be turned inward as far as the midline.

This flap of peritoneum with its intestinal and mesenteric content has the effect of keeping the other intestines out of the way and gives a wholly satisfactory view of the field. The accompanying drawings made from actual dissections will show the structures divided and the relation to the nerve supply (figs. 5 to 10).

It, of course, appears to be a pretty radical and heroic procedure but we believe that in fact it damages fewer structures and gives a more satisfactory abdominal wall after healing has occurred than that obtained by any other incision. The accompanying photographs of a patient operated upon in December, 1924, shows the present condition (figs. 11 to 13). It will be noted that there is practically no assymetry of the abdominal wall, that the bulging from paralysis of the rectus which is ordinarily common after the transrectus approach, has not occurred and except for the scar itself, there is no notable deformity. Of all of the incisions which we have used for this purpose, it seems to us clearly the least damaging and most satisfactory. The ability entirely to control the field with the resulting certainty of managing all the blood supply has been exceedingly satisfactory and has largely put at rest our fear of troublesome bleeding in these cases. While the incision is here put forward chiefly as advantageous in the approach to malignant tumors, I am not at all sure that it does not constitute the most satisfactory approach to the often difficult problems of abnormality of the renal pelvis and ureters. There is an increasingly large group of cases in which we feel required to do various plastic operations upon the pelvis or upper portion of the ureter and the oblique incision does not appear to me entirely satisfactory for this purpose. In many of these problems, the transverse incision alone would be sufficient, thereby saving a definite amount of time in the repair of the wound. I incline to the view that unsatisfactory methods of approach have somewhat handicapped us in dealing with these problems of the renal pelvis and upper ureter and better results will obtain when we get thoroughly satisfactory access to the problem.

THE END RESULT OF HYPERNEPHROMA

GEORGE GILBERT SMITH AND A. B. SHOEMAKER

From the Urological Department, Massachusetts General Hospital

Received for publication June 15, 1925

A study has been made of all cases diagnosed as hypernephroma treated at the Massachusetts General Hospital during the years 1900 to 1923, inclusive. Some 140 case histories were carefully investigated, with the result that all but 62 were excluded because of insufficient data. Without doubt many of the excluded cases were really hypernephromata, as they showed renal tumor and hematuria, but unless this evidence was supported by characteristic pyelograms, it was felt that they should not be included. Of the 62 cases finally accepted, in 52 the diagnosis was verified by the pathologist. In some cases the kidney itself was examined, in others, only some metastatic tumor.

The ages of the patients at the time of admission fell into the various decades as follows:

	Number of cases
0 to 10 years	0
11 to 20 years	2
21 to 30 years	3
31 to 40 years	10
41 to 50 years	11
51 to 60 years	23
61 to 70 years	11
71 to 80 years	2
Total	62

It is seen that the cases occurring during the years 51 and 60 were more than twice as numerous as those in any other decade.

Forty-three cases were in males, 19 in females.

The right kidney was primarily involved in 27 cases, the left in 25. In 9 cases the side affected was not stated, and in one case both adrenals contained hypernephromata of approximately equal size.

It has been our impression that hematuria is the outstanding symptom of hypernephroma. Our statistics do not confirm this belief. Only 27 cases of the 62 had hematuria, and in some of these it was a recent symptom. Thirty-two had had no hematuria; in 3, the presence or absence of this symptom was not noted. Pain occurred more constantly; it was noted as present in 32 cases, absent in 26. In 4 cases the records were indefinite concerning it. By all means the most consistent finding was that of tumor. An enlarged kidney was found on physical examination in 48 cases, in a number of which the patient himself had noticed the mass. No tumor was felt in 12; the presence of tumor was uncertain in 2.

It is obvious that the early diagnosis of renal tumor is a great factor in securing a good operative result. Without some warning symptom, however, how is one to detect these cases before they are far advanced? Seventy-five per cent of this series already showed definite palpable renal enlargement when they applied for relief. Of the 26 cases on which nephrectomy was done, in only one case was it stated that no tumor was felt. In 2 other cases, no mention of tumor was made. All the others had tumors varying from the size of an orange to one that filled the flank. It is to be hoped that the annual examination of individuals, particularly of those past 40, will detect some of these cases earlier than they would otherwise be detected. Every case of enlarged kidney should be regarded as suspicious, whether or not it is accompanied by hematuria, and should be pyelographed, for it is possible to have an advanced hypernephroma without hematuria or pain.

The early occurrence of hematuria is a favorable factor, as it alarms the patient, and should be the signal to the doctor for a cystoscopic study. It is indeed deplorable that this signal is so often neglected. The value of hematuria as a warning is shown by the fact that of the 26 cases considered suitable for

nephrectomy, 61 per cent had hematuria, whereas in the entire series, only 43 per cent showed blood in the urine. As one reads the histories of these cases, he is impressed by the thought, how much better the results would have been had the patients been investigated when hematuria first was seen.

The importance of pain is doubtful. It was seldom very severe, often coincided with bleeding, and was probably due in many instances to clots in the ureter.

In this series of 62 cases, pyelograms were done in 10. All showed the typical appearance of an encroachment upon the pelvis, with a distorted, flattened pelvic outline. The earliest pyelogram was done in 1916; the earliest divided function by phenolsulphonephthalein in 1911.

For clearer analysis of the end results, the cases have been divided into three groups—those in which nephrectomy was done, those in which only an exploratory operation was performed and those cases which had no operation upon the kidney.

Table 1 shows in brief the career of the 26 cases of nephrectomy. To this table is added a twenty-seventh case, one in which Dr. Hugh Cabot removed a hypernephroma of the adrenal without removing the kidney to which it was attached. The tumor was the size of a grape fruit, encapsulated, and with no distinct pedicle. Pathological report—"Tumor 16 cm. long, smooth reddish surface mottled with grayish white areas on section. Microscopic examination shows plexiform masses of epithelial-like cells separated by a very abundant vascular tissue. The cells and general arrangement seem to be similar to that of the cortex of the adrenal gland. Hypernephroma." The operation was done in 1913; the patient, a woman of 48 at that time, was alive and well in April 1925. (Letter from Dr. W. C. McDonald.)

The ages of the cases suitable for nephrectomy were in proportion to the age distribution of the whole series. As has been noted, they showed a rather higher incidence of hematuria than did the series as a whole. Of the 27 cases, there were 4 operative deaths—case 6 died of embolus during operation; case 7, a transperitoneal nephrectomy, died of peritonitis five days after operation (autopsy showed no metastases) case 16 died of pneu-

TABLE 1

Nephrectomy for hypernephroma

CASE NUMBER	SEX	AGE	DATE OF OPERATION	DURATION OF SYMPTOMS	TUMOR	DURATION OF LIFE AFTER OPERATION	END RESULT
1	F.	58	1903	11 years since first hematuria	Size of cocoanut	9 months	Died with pulmonary hemorrhage
2	F.	58	1904	Pain 6 weeks	Size of grapefruit	1 year	Died with general carcinomatosis
3	M.	37	1904	No hematuria	Twice normal size	10 months	Unknown
4	M.	39	1906	Pain four months	Fills flank	2+ months	Died metastases in pleura, lungs and lymph glands
5	M.	42	1906	Hematuria 6 months	Kidney enlarged	3 years	Discharged relieved—Died of accident 3 years later—no recurrence
6	F.	63	1907	Hematuria 10 months	Kidney enlarged and movable	0	Died of embolus during operation
7	F.	45	1908	Tumor 4 years	Size of grapefruit	5 days	Transperitoneal nephrectomy. Died general peritonitis 5 days later. Autopsy—no metastases
8	M.	47	1908	Pain for 9 days	No tumor	8 years	Seen 1915—large tumor upper left quadrant. Died 1916—carcinoma kidney
9	M.	50	1909	Hematuria 2 years	Size of fetal head	10 weeks	Died 10 weeks—"exhaustion"
10	M.	56	1907	Tumor 9 months	Yes	4 months	Died 4 months later—"hypernephroma"
11	F.	63	1909	No hematuria	Yes	1+ year	14 months later reported well. No record of death in State
12	M.	54	1911	Hematuria 4 years	Yes	5+ years	Living in 1916. No record of death
13	M.	47	1913	Hematuria 5 weeks	Size of grapefruit	10 years	Died in 1923 of "cardio renal disease"

14	M.	65	1914	Hematuria 1 month	Yes	5 years	Died in 1919—cerebral arteriosclerosis and heat exhaustion
15	M.	52	1915	Hematuria 6 years	Yes	8 years	Discharged relieved. Died in 1923. Extension of growth into mediastinum and cervical glands
16	M.	65	1915	Hematuria 5 weeks	Size of orange	1 month	Died 1 month of pneumonia
17	M.	28	1916	Hematuria 5 years	Size of cocoanut	(?)	Discharged relieved. No record of death found
18	M.	51	1917	Hematuria 4 years	Fills flank	Few hours	Died postoperative shock
19	F.	44	1920	Hematuria 6 months	Fills flank	(?)	Discharged relieved. No record of death found
20	F.	51	1920	Hematuria 9 weeks	Size of cocoanut	(?)	Discharged relieved
21	M.	36	1921	Hematuria 5 weeks	Lower pole palpable	6 months	Died in 6 months—hypernephroma
22	M.	52	1922	Hematuria 6 months	Size of grapefruit	1 year	Died 1 year later
23	F.	54	1923	No symptoms	Large mass	(?)	Discharged relieved. No record of death found
24	F.	54	1923	Hematuria 8 months	(?)	2+ years	April 1925—alive and well
25	M.	52	1909	(?)	(?)	4 years	Died 1913—"multiple hypernephroma"
26	M.	56	1898	(?)		7+ years	Entered hospital 1905—recurrence in scar. Record of death not found
				Excision of adrenal			
27	F.	48	1913	No hematuria	Yes	12+ years	April, 1925, alive and well

monia one month after operation; case 18 died of shock a few hours after operation. Twenty-three cases were discharged from the hospital. Of these, 8 died within one year, 6 of an extension of the growth, 2 of unknown cause, very possibly also of carcinomatosis. Six cases could not be traced. No record of their death could be found at the State House, or by their Town Clerks.

Case 5 lived three years, died of an accident; no evidence of recurrence.

Case 25 lived four years; died of carcinomatosis.

Case 14 lived five years; died of cerebral arteriosclerosis and heat exhaustion.

Case 26 lived seven years; then growth recurred in scar. Date of death not known.

Case 8 lived eight years; died of carcinomatosis.

Case 15 lived eight years; died of carcinomatosis.

Case 13 lived ten years; died of cardio-renal disease.

Case 24, operated February, 1923, is alive and well April, 1925.

Case 27, the adrenalectomy, operated 1913, is alive and well April, 1925.

Thus it is seen that 4 cases lived three, five, ten, and twelve years without signs of recurrence. One case lived 4 years, two lived 8 years, and died of carcinomatosis. One case lived 7 years at least, but had recurrence then. Six cases have been lost track of, after having been discharged "relieved." Here are 9 results known to be worth while, and 6 unknown results, out of 27 removals of the tumor, in a series of 62 cases in all.

Table 2 gives the salient facts in 19 cases of exploration only. There were 6 operative deaths. Three of these at autopsy showed extensive metastases. Thirteen were discharged from the hospital. Of these 9 died within six months, 4 more within one year.

Under "end result" appears the cause of death as it was given upon the death certificate. Occasionally, as in case 18 of table 2, the cause of death is at variance with the hospital findings. Such cases were investigated with particular care, and were included only when the evidence secured by operator and pathologist was absolutely convincing.

Table 3 gives the 16 cases which had no operation upon the kidney. Five of these died within two weeks after admission. Six entered the hospital because of pathological fractures or metastases in other tissues. In several cases, the hypernephroma was not the cause of death, and was found only at autopsy. Such a case was no. 4. who died of phthisis and in whom small hypernephromata of both adrenals were found. The duration of life of one of these cases was surprisingly long. Case 6, a man of thirty-four, was admitted for tumor of upper arm. This proved to be a hypernephromatous metastasis in the humerus. The arm was amputated, and the patient lived for five years thereafter, dying of "cancer of the kidney." A survey of the 34 cases, exclusive of operative deaths, in which the primary growth was not removed, and in which the approximate date of death is known, shows that the duration of life after the first noted symptom was as follows:

	Number of cases
6 months or under	10
Between 6 months and 1 year	10
Between 1 year and 1½ years	3
18 months to 2 years	2
4 years	1
5 years	1
7 years	1
Uncertain	2

Ten autopsies are recorded.

A review of the pathological anatomy of this series shows that in 12 cases a general carcinomatosis, with invasion of the retroperitoneal lymph nodes, liver, mediastinum and lungs, was found. In 3 cases, glands of the neck were the only obvious metastases. The forehead was affected once, the humerus twice, the fore arm once, the chest wall once. An interesting finding was that of case 16, in which the pathologist found a hypernephroma of the left kidney and a papillary adenoma of the right kidney. There were no metastases.

R. Dresser, of the x-ray Department at the Massachusetts General Hospital, discusses (1) the treatment of metastases by radiation. He mentions the opinion of Piney (2) that the cause

TABLE 2

Exploratory operation

CASE NUMBER	SEX	AGE	DATE OF OPERATION	SYMPTOMS	TUMOR	DIAGNOSIS MADE BY	DURATION OF LIFE AFTER OPERATION	END RESULT
1	M.	65	1905	Tumor	Size of football	Biopsy	11 days	Operative death
2	M.	35	1907	Tumor	Yes	Nephrotomy	2 months	Death—"cancer of kidney," 1/08
3	F.	39	1910	Tumor	Fills flank	Autopsy	16 days	Operative death. Autopsy—general carcinomatosis
4	F.	43	1911	Hematuria	Yes	No microscopy exploration	7 months	Died 10/11—"hypernephroma kidney"
5	M.	52	1911	Hematuria 6 years	Yes	Biopsy	1 year	Died 6/12—"cancer kidney"
6	F.	19	1912	Hematuria 6 months	Yes	Autopsy	1 year	Died 2/13—autopsy—hypernephroma left kidney, metastases in liver and lungs
7	F.	40	1904	Tumor	Yes	Biopsy	8 months	Died 3/05—"malignant cystoma"
8	M.	56	1911	Tumor	Yes	Biopsy	0	Operative death—hemorrhage
9	M.	29	1912	Tumor	Yes	Biopsy	5 months	Died 3/13—"hypernephroma"
10	M.	62	1912	Hematuria 1 month	Size of grapefruit	Autopsy	5 days	Operative death. Autopsy—metastases in abdominal glands and right adrenal
11	M.	48	1916	Pain 2 months	Size of orange	Biopsy	2 months	Died 3/16—cause not stated
12	M.	48	1917	Tumor	Fills flank	Biopsy	2 days	Operative death.—Operation showed metastases in liver
13	M.	47	1917	Tumor	Fills left upper quadrant	No microscopy	3 months	Died 7/17—"sarcoma of kidney"

14	M.	63	1920	Hematuria 4 years	No	Pyelogram	3½ months	Died 8/20—"cancer of kidney"
15	M.	54	1921	Hematuria 2 years	Fills flank	Clinical	4 months	Died 3/22—"hypernephroma"
16	M.	60	1923	Hematuria 13 months	Size of 2 fists	Clinical	5 months	Died 12/23—"cancer of stomach"
17	M.	55	1923	Pain 5 weeks	Large mass	Pyelogram, clinical	2 months	Died 5/23—"sarcoma of kidney"
18	F.	19	1916	None	No	Biopsy	5 months	Died 5/17—"tuberculous peritonitis"
19	M.	58	1916	Pain 9 months	No	Biopsy	4 days	Died 6/16—operative death

TABLE 3

No operation upon kidney

CASE NUMBER	SEX	AGE	ADMITTED	SYMPTOMS	DIAGNOSIS MADE BY	DURATION OF LIFE AFTER ADMISSION	END RESULT
1	M.	55	March, 1906	Hematuria 3 months	Biopsy—neck	6 months	Died October, 1906—"cancer of kidney"
2	M.	67	August, 1910	Exhaustion	Autopsy	4 days	Died August, 1910—autopsy—hypernephroma of left kidney, papillary adenoma of right kidney
3	M.	40	October, 1910	Tumor—foot	Autopsy	1 month	Died November, 1910—small hypernephroma of kidney
4	M.	54	March, 1913	Phthisis	Autopsy	2 weeks	Died April, 1913—autopsy—hypernephroma of both adrenals
5	F.	40	April, 1903	Tumors—forehead and arm	Biopsy	2 months	Died June 18, 1903
6	M.	34	August, 1905	Tumor—arm	Biopsy, arm amputated	5 years	Died January, 1910—"cancer of kidney"
7	F.	63	February, 1913	Spontaneous fracture of humerus	Biopsy	5 days	Died February, 1913, of pulmonary embolus following operation for reduction of fracture
8	F.	52	March, 1919	Coma	Autopsy	Few hours	Died March, 1919—autopsy—left hypernephroma, metastases of mediastinum and abdominal viscera
9	M.	63	October, 1921	Hematuria 6 months	Autopsy	4 days	Died October, 1921—autopsy—hypernephroma of right kidney extended into vena cava. No metastases

10	M.	52	June, 1921	Hematuria 4 months	Pyelogram	Unknown	Discharged unrelieved June 8, 1921
11	M.	79	December, 1921	Pain 2 months	Pyelogram	2 months	Died February, 1922—"cancer of kidney"
12	F.	28	March, 1919	Loss of weight 6 months	Biopsy—chest wall	1 month	Died April, 1919—general carcinomatosis
13	M.	39	June, 1912	Tumor—neck	Biopsy	2 years	Died April, 1914—"sarcoma parotid"
14	M.	71	July, 1916	Pain in back	Pyelogram	1 month	Died August, 1916—"sarcoma of kidney"
15	F.	60	September, 1917	Pain and mass	Pyelogram	6 months	Died 1918. Cause unknown.
16	M.	67	April, 1921	Tumor chest wall	Biopsy	11 months	Died March, 1922—"sarcoma. Metastases of breast and spine"

TABLE 4

Occurrence of metastases

TABLE NUMBER	CASE NUMBERS	AUTOPSY OR BIOPSY	METASTASES
1	1	Autopsy	Lungs(?)
1	2		General carcinomatosis
1	4		Pleura, lymph glands, lungs
1	8		Tumor left upper quadrant—right nephrectomy 6 years before
1	9		Suprarenal glands
1	25	Biopsy	Left forearm
2	3	Autopsy	Liver, kidneys, nodes, omentum, lungs, subpleural tissue
2	6	Autopsy	Entire left side of abdomen filled by mass. Left renal vein and vena cava filled by growth. Metastases in liver and lungs, not in brain
2	9	Biopsy	Forehead
2	10	Autopsy	Hypernephroma left adrenal with metastases in retroperitoneal glands and right adrenal
2	12		Liver
2	18	Biopsy	Omentum and peritoneum
2	19	Biopsy	Liver
3	1	Biopsy	Glands of neck
3	2	Autopsy	Hypernephroma left kidney; papillomatous adenoma of right kidney, no metastases
3	4	Autopsy	Hypernephroma of each adrenal. Metastases in retroperitoneal lymph glands, mediastinal glands, pleura, peritoneum
3	5	Biopsy	Forehead
3	6	Biopsy	Right humerus apparently only metastases as patient lived 5 years after amputation
3	7	Biopsy	Right humerus
3	8	Autopsy	Metastases in retroperitoneal lymph nodes, lungs, liver, retroperitoneal tissues of pelvis and subcutaneous tissues of trunk
3	9	Autopsy	Hypernephroma of right kidney with extension into right renal vein and vena cava. No metastases
3	12		General carcinomatosis of brain, breast, kidneys
3	13	Biopsy	Neck
3	16	Biopsy	Chest wall

for the frequent lodgement of metastases in the upper end of the humerus and femur is the persistence in these regions of red marrow. The shafts of the bones are filled with fatty marrow, which has relatively large blood channels, whereas the red marrow consists of innumerable blood channels with extremely thin walls. The difference in rate of flow through these channels is responsible for the deposition of emboli of tumor cells in this region.

Dresser has noted a marked decrease in size in hypernephromatous metastases in the sternum and in the clavicle under large doses of high voltage x-ray. These must be carried to the point of erythema. He points out that there may be but one metastasis, and that removal or destruction of this will greatly prolong life. Such a situation existed in case 6, table 3, a patient who lived five years after amputation of humerus for metastatic hypernephroma.

In reviewing the question of the operability of hypernephroma, one is confronted by the necessity for careful study to determine the presence of metastases. If metastases can be shown to exist in the other viscera, it is probable that the patient will live as long without operation as with it. If there can be demonstrated only a single metastasis, such as a gland in the neck which is accessible for removal or for radiation, it may be worth while to excise the original tumor. The fact that the growth extends into the renal vein should not contraindicate nephrectomy. Foulds (3) found that of 200 cases of tumor of renal parenchyma at the Mayo Clinic, the renal vein was involved in 45. Five of these 45 were alive from three to fourteen years after operation. W. J. Mayo (3) has removed plugs of tumor from the renal vein with good success. One case was alive five years later. Allemann and Bayer (4) report a case which was well four years after nephrectomy, in spite of extension of the tumor into the renal vein. In our series, case 6, table 1, died during nephrectomy through the dislodgement of a mass of tumor tissue growing into the renal vein.

CONCLUSIONS

1. The records of 62 cases of hypernephroma were studied.

2. Of 27 cases in which the tumor was removed, the operation could be called worth while in 9 cases. Six more cases were discharged relieved, but lost track of.

3. The duration of life in cases not subjected to nephrectomy, and the pathological anatomy of the disease are discussed.

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SOLITARY SEROUS CYST OF THE KIDNEY WITH REPORT OF A RECENT CASE

RICHARD F. O'NEIL

Boston, Massachusetts

Received for publication June 15, 1925

The reports of cases of solitary serous cyst of the kidney appear from time to time in medical literature, but their occurrence is of sufficient rarity to justify the putting on record of the following case operated on by the writer during his last service at the Massachusetts General Hospital, February, 1925.

The differential diagnosis is rarely made in these cases before operation, but in this case we were able to do so with reasonable certainty by means of abdominal palpation, the appearance of the pyelogram and the x-ray findings. The case history was as follows:

R. M. A woman, married, forty-seven years of age, entered the Urological Service at the Massachusetts General Hospital, February 24, 1925. Principal complaint, pain in the right flank, radiating to the back and thigh. Duration for twenty years, off and on. At first, there were long intervals between the attacks, but of late they have occurred every few days, and with increasing severity. Associated with these attacks was some frequency of urination and patient states that at times they were accompanied by a mild degree of hematuria. Six weeks ago her physician discovered a mass in the right side of the abdomen and referred her for examination.

Previous history. Acute catarrhal jaundice about twenty. Fifteen years ago she had pulmonary tuberculosis with cough and positive sputum. She was treated in a sanitarium with complete recovery.

Examination. Well developed and nourished woman. Chest, pelvis, and extremities normal. Abdomen: In the right side on a level with

the umbilicus is a tense, rounded, movable, slightly tender tumor, the size of a grapefruit. It is not connected with the pelvic organs. It extends through to the back and on pressure can be made to move backwards towards the costo-vertebral region.

Temperature normal; pulse 70; blood pressure 105–80. Wassermann negative. Non-protein nitrogen 33 mgm. per 100 cc. Renal function,

FIG. 1. PYELOGRAM OF RIGHT KIDNEY SHOWING TORSION AND PTOSIS OF KIDNEY

Lower pole of kidney and cyst have been outlined in the print. They are easily visible in the x-ray plate.

phenophthalein, intravenous, appearance time three and one-half minutes, 40 per cent the first hour, 5 per cent the second. Urine: Pale, clear, acid, no albumin, no sugar, sediment negative. Blood: No anemia, white count, 9800.

Cystoscopy. Normal bladder and ureters, both ureters catheterized without obstruction, normal flow of clear urine from each, renal func-

tion, appearance time, right kidney, six minutes, 20 per cent excreted in fifteen minutes, diluted to 250 cc. Left—appearance time four minutes, 70 per cent in fifteen minutes, diluted to 250 cc. Sediments from each kidney showed a few red blood cells and a few epithelial cells.

Pyelogram. Right kidney shows some ptosis, and apparent tortion of the kidney, the calices pointing in a downward direction (see fig. 1).

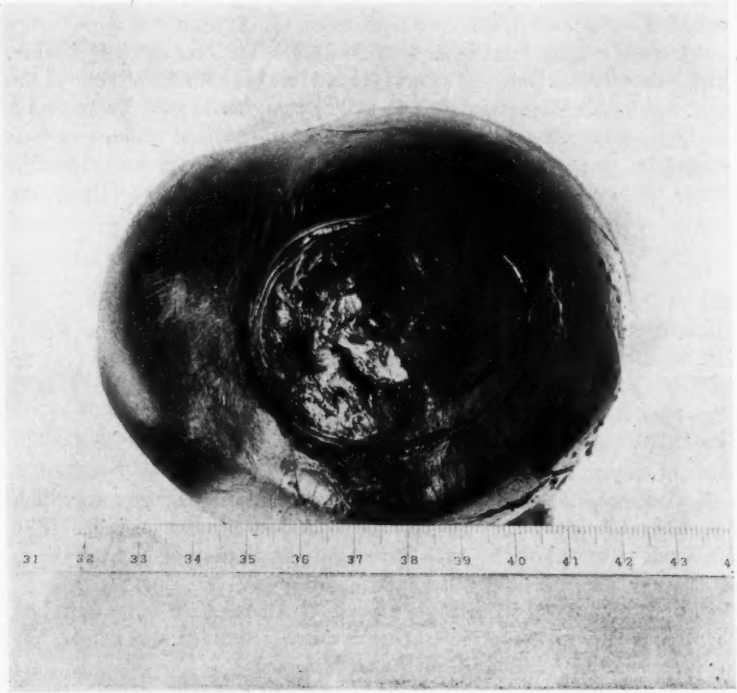

FIG. 2. SOLITARY SEROUS CYST OF LOWER POLE OF KIDNEY, SHOWING AREA OF ATTACHMENT TO RENAL CORTEX

Left kidney—pelvis normal in size, not dilated, calices show normal cupping, the ureter normal. The x-ray shows on the right a rounded shadow extending half way down over the crest of the ileum and apparently corresponding to the position of the tumor as made out by palpation. There is marked calcification of the costal cartilages.

Preoperative diagnosis. Cyst of the lower pole of the right kidney.

Operation. February 10, 1925. Dr. R. F. O'Neil. Gas oxygen anesthesia. Right oblique loin incision 8 inches long. Kidney was exposed, normal in appearance and feel. Arising from the lower pole was a solitary cyst the size of a grapefruit. Cyst and kidney were easily delivered; cyst was found to arise from the convex surface of the lower pole of the kidney. As the kidney was perfectly normal, the cyst was removed. As it could not be enucleated, a thin layer of the renal cortex was excised with it, leaving an area about 2 inches long and 1 inch wide. In the excision of the cyst a small opening had been made into one of the minor calices. This was closed with catgut sutures. There was a moderate amount of bleeding from the kidney surface which was controlled by three catgut matress sutures. The incision was closed in layers with rubber tissue drain left to the line of suture. There was present a large abberant artery, about the middle of the lower pole of the kidney, apparently coming from the aorta.

The cyst on removal measured 10 x 7 cm. (see fig. 2). It contained 400 cc. of clear, straw-colored fluid, which on analysis showed the following: Reaction, alkaline; specific gravity, 1018; total nitrogen, 202 mgm. per 100 cc.; non-protein nitrogen, 24 mgm. per 100 cc.; uric acid, 2.8 mgm. per 100 cc.; sugar, 1.10 mgm. per 100 cc.; NaCl, 6.76 mgm. per 100 cc.; total protein, 1200 mgm. per 100 cc.

Pathological examination. A thin cyst wall, one area showing a thin layer of degenerated renal cortex.

Convalescence uneventful except for some gastric disturbance which patient had suffered from before. There was no urinary leakage. The drain was removed on the sixth day. Patient discharged eighteen days after operation.

Patient seen April 30, 1925, about eleven weeks after operation; has been relieved of all symptoms; urine normal. Right kidney can be felt easily; normal in size but below the twelfth rib.

The symptoms presented in this case were very similar to those of an intermittent hydronephrosis, and were undoubtedly caused by the sagging of the kidney, due to the weight of the cyst, and increased in severity during the latter years because of the constantly increasing size of the cyst.

There are no typical symptoms of the condition, the foregoing and pain due to the pressure on other organs from the size of the cyst being as characteristic as any.

Harpster (1), has tabulated 95 cases of this condition. He also deals with the etiology, symptology, diagnosis and treatment.

In going through the records of the Massachusetts General Hospital I was able to find but 9 cases—5 in men, and 4 in women—the earliest operated case dating back to 1879. Of the former, 3 were small cysts which were discovered during operations for other lesions of the kidney and were excised. One, a larger cyst, was in a horseshoe kidney. This was incised and drained. The fifth case was apparently a large cyst into which a hemorrhage had occurred.

The cases occurring in women were much more typical, all being of large size, they being described as a palpable tumor in one loin or the other. They were four in number. One was operated on in 1884, and a large tumor mass in the left flank was first aspirated and later drained by suturing the cyst to the skin. In another case, there was found a large cyst containing 45 ounces of fluid. This was incised and drained. A third case, where the cyst was described as being the size of an orange, was also resected and drained. The fourth may be considered as doubtful; here a large retroperitoneal cyst was discovered in the left upper quadrant, which ruptured on being handled, but was thought to arise from the kidney. All of these 9 cases recovered, but some of them must have carried a sinus for a very long time; nowadays they would not have been treated in that manner.

The treatment should consist of removal of the cyst when possible. If this cannot be done, of partial nephrectomy, and, in some cases, total nephrectomy.

Dr. J. B. Blake reported a case very similar to mine before the New England Branch of the American Urological Association, November 5, 1907 (2), and Dr. W. C. Quinby reported 3 cases before the same society at one of the meetings this winter. These cases are not included in Dr. Harpster's tabulation.

The condition is a rare one which is my excuse for presenting it before this Society.

REFERENCES

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DISCUSSION

Dr. JOHN H. CUNNINGHAM (Boston): I am interested in the matter which Dr. Cabot has brought before us. I think we all realize that the success in dealing with these large tumors of the kidney depends chiefly on proper exposure. Anything that will lead us to a better means of dealing with the pedicle in these malignant tumors is most welcome.

I am not at all clear as to what position the patient assumes in using the incision described. I would like to know whether the rectus muscle is divided to the median line, and I would also like to know the manner in which the repairs of the wound is made. It seems to me the crux of handling malignant tumors of the kidney depends upon proper exposure and the end results upon proper repair of the wound. The conservation of innervation is appealing but secondary to good exposure, and a solid repair.

I think Dr. O'Neil is to be congratulated on making a preoperative diagnosis of solitary cyst of the kidneys. It is the only instance that I know of, in which the diagnosis has been made preoperative.

I reported 4 cases before this Society some years ago, and at that time laid special emphasis on a point which Dr. O'Neil has brought out which is not to do a nephrectomy, but to resect the cyst. My feeling is that when the cyst cannot be resected, it should be drained rather than to remove the kidney. The removal of the kidney for cyst has resulted in an unnecessary mortality.

Tuffier in 24 nephrectomies for this disease records 11 deaths; Quenu in 7 nephrectomies had 5 deaths; Lejars in 16 had 7 deaths. The explanation of the mortality to be found is probably in that the affected kidney being little disturbed in its function when sacrificed, throws very suddenly upon the other kidney the duty which the kidney with the cyst had been performing very well.

I want to emphasize the point that when we do encounter these cysts, we should endeavor in every way to conserve the kidney tissue. If the cyst for any reason cannot be resected, it is far better to bring it to the surface and drain it, which has been done most satisfactorily by many operators. The sinuses in the reported cases have not persisted for any great length of time, and the mortality in this group is negligible.

Dr. BENJAMIN S. BARRINGER (New York): Dr. Cabot's incision appeals to me greatly, and I certainly shall use it on the first occasion I have. I would like to know how the patient lies. If you do not have to put him on his side, I should think it would simplify the procedure very much.

Dr. Smith and Dr. Cabot also brought up two interesting points about the local recurrence, after nephrectomy, of these tumor cases. I was interested in Dr. Smith's report that case after case apparently had died of a kidney carcinoma; in other words, of a local recurrence. I have had 2 cases, one of which went four years and the other went five years. In both of them there was a reasonable chance that we had gotten all the tumor out; in one a very good chance—and both of them recurred locally.

That brings up the point, aside from Dr. Cabot's suggestion of removing the entire fatty capsule, if we may not use x-ray in some way or another to devitalize what we may have left behind, either before or after operation. I think it certainly would be worth while doing. X-ray before operation would not greatly add, or possibly would not at all add to the trouble of nephrectomy.

Dr. Smith has told about the metastases into the renal vein. I think some people have even gone farther and suggested that the metastases even entering the vena cava have been dealt with. I think Dr. Beer has 1 case of a metastasis into the vena cava, which he removed; the patient live three or four years, and when last heard of, was still carcinoma-free.

Dr. HUGH H. YOUNG (Baltimore): It seems to me this subject

is of very great importance, and we owe these gentlemen a debt of gratitude for bringing it before us.

We have recently gone over our statistics of kidney tumor and have simply been amazed to see how rotten they are. The more we have studied the results, and the more we have studied the autopsy cases, the more we have realized how extremely difficult it is to do what Dr. Cabot has advised, and which we think is very important; that is, to remove the fatty capsule and glands, and often adrenal glands, if you can. In recent cases, we have always done a transperitoneal operation and have removed the peritoneum covering the tumor mass. In one case we removed a mass of peritoneum at least as large as the hands, and it is remarkable how much easier it makes operation.

You simply make an incision on the inner border of the tumor, and continue all around the outer edge of the tumor, then push the large intestine away and go down and get your pedicle. You thus avoid all that bleeding that comes from the separation of the fatty capsule from the peritoneum. You avoid the veins that are so tortuous, dilated and so troublesome. You stop most of the hemorrhage at the beginning, and then the rest of the operation is fairly easy.

The peritoneum in these cases of large tumor of the abdomen is so lax and has been so greatly distended by the intraperitoneal projection of the mass that after removing all the peritoneum covering the tumor, with it, you will have plenty of redundant peritoneum. In none of the cases have we had any difficulty in bringing over and having a complete closure of the peritoneum.

I think my technique very greatly simplifies the transperitoneal operation. It also makes it possible to get the lymph glands, the fat and also the adrenal gland much more easily. It seems to me, it is almost impossible extraperitoneally, except in smaller cases, to do as thorough surgery as you ought to. Our results are very poor, and I feel confident that it is due to the fact that we have generally not gone into the abdomen and have not removed the peritoneum covering the tumor mass.

Dr. HERMAN L. KRETSCHMER (Chicago): The problem in

handling renal tumors, I do not think is primarily a problem of technique as much as it is a problem of early diagosis. It seems to me, if we can get the cases in early, that operation is relatively simple.

A good many of the practitioners who see these cases have been brought up on the old triad of tumor, hematuria, and pain. Dr. Braasch, many years ago, showed that this triad was present in only a very small percentage of a large series. I think he reported 80 or 90 cases at that time,—he had seen the presence of this triad, upon which most of the men rely who see these cases before we see them, in only 30 or 35 per cent.

It seems to me that we ought to in some way bring before the profession and the laity the significance of hematuria so that the patient can have the benefit of an early operation.

Then there is another group of cases in which there are no urinary symptoms at all, in which the symptoms are gastro-intestinal or general, in which the patients come to the hospital because of general symptoms, such as anemia, shortness of breath, and various gastro-intestinal symptoms. Those patients all come in late in the course of the disease.

Then there is a third group in which the patients come in because of evident metastases, which are often not recognized. I refer to those cases, for instance, who have skin metastases, and who are operated upon for a wen and histological examination shows it to be a metastatic hypernephroma. Metastases to the osseous system are supposed to be rather common.

In one of our cases a patient had had multiple fibromate removed from his nasal cavity. Histological examination showed the presence of metastatic hypernephroma.

We are perfectly familiar with cases of spontaneous fractures, and this type of case offers nothing in the way of treatment.

Drs. Cabot and Young both have spoken of getting out the fatty capsule and as many of the glands as possible, and this I believe is a very important point. However, I still feel that that does not solve the problem all of the time. I remember 2 patients in whom I had removed all of the fatty capsule, and yet both of those patients,—one two years and the other patient

five years later, came back to the Clinic with symptoms of metastases to the brain, the diagnosis in each instance was made by a competent neurologist.

So that even when you do a perfect nephrectomy and get out all of the fat, it does not necessarily exclude the possibility of metastases, either early or late.

Dr. WILLIAM C. QUINBY (Boston): I think that we must all realize that results in renal tumors must inevitably be rather gloomy; that we must expect a relatively high mortality because of the slow onset of significant symptoms. Even if all attending family physicians were the most acute possible in sizing up what was going on, and referring patients for more thorough diagnosis, I feel, that the natural onset of a good many renal tumors is so insidious that we must expect a fairly high mortality. This, however, is no argument against every effort which we can make to eradicate such a tumor once it is found to exist, and I wish to call your attention to the fact that the mere size of a tumor has no relation whatsoever to the outcome, or at least only a relative relation to the outlook for cure, because before operation, and before histological investigation of any given renal tumor, we have no absolute knowledge in regard to the relative degree of malignancy or benignancy of such a growth.

I have 1 case in mind especially (and I know there are others which I do not happen to recall at the moment) in which there was a very enormous mass filling the whole of the left loin, and presenting a history of recurring attacks of hematuria, lasting over nineteen years. With prayer and every other form of accessory aid that we could get, we operated on this poor individual three times, before succeeding in controlling the situation sufficiently well to get the tumor out. On histological examination, made in a very thorough way, there was no malignant tissue to be found. The tumor was an enormous, benign adenoma of the kidney.

The occurrence of even a single case of this sort, I feel, makes it imperative that we fight hard in every instance.

In regard to incision, I have been very much interested in

Dr. Cabot's communication, because it is quite along the line which I suggested a few years ago at the Clinical Congress of Surgeons, held at that time in Montreal. My communication did not concern itself especially with incision but more directly with an attack on the renal pedicle first, before attempting enucleation of the tumor.

I should like to ask Dr. Cabot whether he cuts across the rectus transversely? It is not always necessary in my hands, if the patient is not very heavily muscled. Sections of the rectus sheath, front and back, with retraction of the muscle belly, is quite sufficient. In other respects, however, I think that I have used an incision analogous to that of Dr. Cabot, operating, however, with the patient in the lateral position, and I grant you sometimes have to reach quite a way forward to get at the upper part of the anterior portion of the incision.

I also have resected peritoneum, as suggested by Dr. Young, but not as a routine measure. I think his is a very valuable suggestion. In those cases in which I have resected peritoneum, it has been because I was afraid of a definite extrarenal tumor involvement. I have not done it independently of any ocular evidence of involvement of the peritoneum. It is very easy to do, however, and I think probably should always be done.

Dr. WILLIAM E. LOWER (Cleveland): One of the many discouraging features of malignant tumors is the fact that late recurrence often takes place. In many cases when we are about ready to assure the patient that our treatment has been successful, a metastasis occurs—as Dr. Smith has pointed out. We have found that if the very large tumors in children—sarcomas—which we so often see and which seem entirely inoperable, are subjected to x-ray treatment for a time the tumor very materially decreases in size and becomes operable. I recall a case in which the tumor decreased to one-half its former size and I then operated upon the patient and did not notice that the vascularity had been increased to any great extent. In one case as a result of x-ray treatment the child gained in weight and general appearance and it seemed as though favorable results

were to be secured, but after four months the tumor began to grow rapidly and caused death. I am sure therefore that we cannot depend upon the x-ray alone but the x-ray followed by operation is worth trying. I recently had a case which we diagnosed before operation. The x-ray picture showed a perfectly smooth tumor attached to the kidney; there was no hematuria but the patient suffered from the pressure of the tumor. If a tumor is situated in the lower pole of the kidney, it is, of course, quite easy to remove; but if it is situated in the upper pole it is not so easy a task to remove it. I would like to ask Dr. O'Neil in how many cases the tumor was in the lower and in how many in the upper pole of the kidney. Of course, these tumors can be removed without doing a nephrectomy. As a rule they are easy to dissect out and there is usually very little hemorrhage.

Dr. GILBERT J. THOMAS (Minneapolis): I would like to report a sudden death following the application of a pedicle clamp when removing a large hypernephroma. The pedicle was very broad and the tumor had undoubtedly grown into the renal vein. When the clamp was applied a bit of the tumor was evidently broken off and lodged some place in the lung or brain and produced sudden death.

I wish Dr. Smith would tell us from the study of the cases which he reports, whether in his opinion, it would not be better to refrain from clamping the renal vessels when tumor tissue is found growing into the vein.

Dr. HUGH H. YOUNG (Baltimore): I had a case of adrenal tumor in which I put on a clamp and left it on four and one-half days. The resident removed it, and the patient died in four minutes and a half.

Dr. MONTAGUE L. BOYD (Atlanta): May I ask a question or two about the methods Dr. Cabot employs in his operation—about the position of the patient on the table, how far back he starts his incisions, whether he uses "stay" sutures, and how soon he gets his patients out of bed. This incision seems to offer

me the very thing for which I have been looking for the exposure of kidneys. It may be that it can be used even in the cases of infected kidneys which have short pedicles and in which the patients are in very bad condition. I have been in the habit, in the last year or two, of using mercurochrome in the kidney wounds of patients with infections, thoroughly washing the wound out with mercurochrome, and my results with the prevention of infection have been very good, not only in the wound itself but in the abdominal wall where it has been closed. It seems to me, if you do that with this type of incision and can avoid infection, it would be possible to employ it in the infected cases, with a great saving in time and less risk of a mortality.

Dr. HUGH CABOT (closing): May I take the liberty of discussing Dr. Smith's paper in the closing? I note particularly in Dr. Smith's paper the confusion which is everywhere here in regard to these tumors. I remember very vividly the case of hypernephroma of the adrenal which I removed. That should not have been so called. That was a tumor of the adrenal. Of course, the word "hypernephroma" has been chucked in here to bait the animals, and to keep us from the necessity of deciding what this tumor is.

We have come to believe that there is a very important variation in the malignancy of these tumors. Our pathologist, Dr. A. S. Warthin, goes so far as to describe two types of hypernephroma—the benign and the malignant. Of course, I entirely balk at that classification, but there is clear evidence from the history of these patients of very great difference in their malignancy. For instance, there is my series 1 case at fifteen years, fifteen years from the beginning of symptoms, and 2 cases at ten years, before these patients finally came to operation,—indicating a very benign condition, running over a period of years. So that I think there is here,—and some day we shall come to recognize it,—a fairly clear distinction, characteristic of these tumors.

I should hope at the same time that we should come nearer getting a satisfactory classification. I do not like the ducking of the nature of this tumor.

But I think that patient of mine, referred to, ought clearly not to be classified in this group, but in the other group, and therefore not bearing upon the question of recurrence.

I am sorry that in my attempt to cut down my paper, I did not make myself at all clear in regard to questions of position, and so forth. I think it is clear in the paper. In regard to position, I put sand-bags or something under the flank, so that the patient is slightly rotated to one side, but not at all in the lateral position. The incision begins at about the anterior border of the lumbar group of muscles, and just misses the border of the twelfth rib, sloping slightly downward. That gives me, I think a very much better approach to the pedicle, which is the thing with which we are all chiefly concerned. I have believed it to be really important to divide the rectus muscle because in no other way can you make the vertical portion of this incision, which I think is very important for exposure and does absolutely no damage. The division of the rectus muscle appears to me to be unimportant, if you are going to divide the sheath, because I believe that in dealing with any muscle, when we come to unite them, we do not unite the muscle, we cannot unite it, but we do unite its sheath, and if there is a good sheath, we get along very well.

Questions were asked in regard to repair. In regard to the rectus, I repair the sheath and let the muscle go. The later results appear to show that the union by scar and the ultimate pulling together of that scar in the rectus is perfectly satisfactory. In the other muscles, I try to utilize the fascial coverings of those muscles, having abandoned, as we all have, the attempt to make a suture stick in the muscle itself. Of course, it will pull out. But I feel agreeably surprised, in the course of five years, to see how little deforming these scars are, and how strong the abdominal wall, and free from the common objections of these apparently very radical incisions.

I quite agree with what Dr. Young says about the removal of the peritoneum. I think I should have mentioned it, but only as an incident to the very thorough removal of everything in the neighborhood. I believe that the greatest mistake that has

been made in the past, in dealing particularly with hypernephroma, and which is still being made, not by the expert, but by the general surgeon, is the attempt to take out that kidney as if it were a kidney,—because it is not a kidney, it ceases to be a kidney,—and the normal method of cleaning the kidney and fat capsule is ruinous, and I believe accounts for half, if not more, of the mortality in these cases, from what is called shock, and should be called hemorrhage.

The difference in the ease with which one deals with these tumors, if one takes fat capsule and all, adrenal gland, and everything in the neighborhood which appears to belong together, is very surprising. I think I offered Dr. Keyes the first suggestion, that if you did not get into a dog fight between the kidney and the fat capsule, you would live more happily and probably longer. It is undoubtedly very true.

Dr. GEORGE G. SMITH (closing): Dr. Barringer has spoken about the recurrence of growth locally, after nephrectomy, but in this series there was only 1 case in which that occurred. The cases that died of carcinoma of the kidney were those of the second and third group, where the kidney was not removed. In the actual nephrectomies, there was only one case of local recurrence, I think. The other cases died of general carcinomatosis.

The value of x-ray, postoperatively, is, I think, considerable. I know of one case which came to the Huntington Hospital, having had a nephrectomy for hypernephroma done by some other surgeon, who said that malignant tissue he knew was left in the perirenal area. The patient was given an extensive x-ray treatment, so extensive that he had really second degree burns, but that was about two years ago, and I saw him a short time ago, when he appeared to be perfectly well, with no mass that you could feel whatever, in the region of the kidney. I think that x-ray, pushed to the limit, is of great value, if you know that you have not been able to remove all of the tissue.

Dr. Thomas spoke about the danger of squeezing off emboli from growths in the renal vein, and I should feel that that was

a very real danger. On the cases that I have done, where a growth has been found, the clamp has always been proximal to the growth, so that when the vein was cut across, the growth was removed with the kidney end of the vein. I should think that if one felt, on getting the pedicle between the fingers, that there was a lot of thickening there, it would give him cause to stop and consider whether he was going to crush that ruthlessly and possibly squeeze off an embolus.

I know of no one who is more competent to speak of the actual diagnosis of Dr. Cabot's case than he himself, but all I can say is that I took the pathologist's diagnosis. The pathologist had diagnosed several other tumors which were primary in the adrenal, as hypernephromata. As I understand it, we do not know the origin of these tumors. In their cellular growth, they apparently resemble adrenal tissue, and have been believed to be due to the occurrence of adrenal in the renal tissue. Consequently, it seems fair to assume that they may occur in the adrenal tissue as well as in the kidney tissue. I put this case under a special heading in the table and marked it plainly as an adrenalectomy, so that if any one wished to discriminate, he could do so.

Dr. RICHARD F. O'NEIL (closing): In regard to Dr. Lower's question, my impression is that the great majority of these cysts occur at the lower pole—all the ones at the Massachusetts General Hospital did—but that tabulation of cases was collected by Dr. Harpster, and I did not go into it very carefully. They are all reprinted in the Journal of Urology for February.

THE FREQUENCY OF BILATERAL RENAL TUBERCULOSIS

J. DELLINGER BARNEY AND STEPHEN G. JONES

From the Urological Department, Massachusetts General Hospital, Boston, Massachusetts

The frequency of bilateral renal tuberculosis, existing when the patient first presents himself, has been attested to by all writers. Peacock (1) reports it in 60 per cent, Kapsammer (2) in 64.9 per cent, Wildbolz (3) in 10 per cent, and in our own group of 100 cases to be dealt with later, it was found in 24 per cent. Waldschmidt (4) found it at autopsy in 70.6 per cent of 119 cases of renal tuberculosis.

With these impressive figures in mind, and realizing the difficulties often met with in the diagnosis of renal tuberculosis, we cannot but feel that in cases of so-called unilateral infection the apparently healthy kidney may also be tuberculous more often than is realized. While cystoscopic examination of the bladder will generally show changes in the mucosa, especially around the ureter of the affected side, which one is in the habit of calling "characteristic" of tuberculosis, it is also generally acknowledged that these changes may sometimes be absent, extremely slight, or of an entirely uncharacteristic nature. The silence of renal tuberculosis, with regard to symptoms referable to the kidney, has been the subject of numerous communications. The absence of bladder symptoms or their mild character has also been touched upon by many writers. Roentgenograms and pyelograms are often either negative or misleading, unless perhaps in the more advanced cases. While the urine from a tuberculous kidney generally contains pus in greater or less amount, the nature of the disease is such that even this sign may fail at times. Alessandri (5), writing on this subject, says that renal tuberculosis is subject to remissions, sometimes of very long duration, due not to

recovery, but to the walling off of the ulcerocaseous focus. He quotes Carlier, Desnos, Heitz-Boyer and others, all of whom have cited cases of this sort, showing that the disappearance of pyuria and bacilluria may result from a partial occlusion of the kidney so that the diseased organ may show a clear urine without pus or tubercle bacilli. While in the majority of cases the tubercle bacillus is to be found either in a smear of the stained sediment, or by guinea pig inoculation, all writers agree as to the fallibility of both these methods and all report varying percentages of success. Wildbolz (3) claims that smears are positive in about 90 per cent; Furniss (6) reports positive smears in 85 per cent and believes the percentage would be even greater if the examination was always made by an expert. Hyman and Mann (7) obtained positive smears in only 65 per cent of a series of 102 cases, but state that this figure would no doubt be higher had repeated search been made. In a series of 100 cases at the Massachusetts General Hospital reported recently by Jones (8) the smears were positive in but 60 per cent. Here again repeated examination would undoubtedly give better results. It seems to be the concensus of opinion that two factors are at work in determining the percentage of positive smears, one being that to which attention has already been called, namely, the tendency of the disease to wall itself off intermittently and for a greater or less length of time. For this reason the writers agree with Brown (9) that great emphasis should be laid on the value of frequent examinations, in the hope of a so-called "shower" of bacilli. But the second reason, quite as important, is that he who makes this examination should not only be skilled in its performance, but also should be able and willing to spend almost unlimited time in his search of the slide. As Jones (8) says, "several hours search will often disclose the solitary group of bacilli which otherwise will be missed."

While some authors believe that the guinea-pig test is practically infallible there seems to be much disagreement. In 1911 one of us (J. D. B.) together with E. L. Young (10) collected 197 cases of renal tuberculosis at the Massachusetts General Hospital in which guinea-pig inoculations had been made. It was

found that there was an error on the part of the pig of only 0.5 per cent. Hyman and Mann (7), on the other hand, report negative results in 36 per cent. Various writers have reported many proved cases of renal tuberculosis in which the guinea-pig test was negative. Here again, as in the smear, several factors are responsible for the negative results. The tendency of the disease to close itself off plays its part, while the technic of the inoculation is a factor of the utmost importance. If improperly done it is useless. Brown (9) has stated that negative guinea-pig tests may sometimes be accounted for by the fact that the bacilli are dead. Hryntschak (11) on the other hand, says that one reason why the guinea-pig test is so often negative is due to the particular strain of bacillus. He cites 4 cases, reported by Lowenstein in 1913, due to avian tuberculosis. As this bacillus seems to have a special affinity for the kidneys in man but is not pathogenic for the guinea pig, a negative inoculation test is to be expected.

We have felt it important to discuss at some length the more outstanding difficulties of making a diagnosis of renal tuberculosis for the reason that these are applicable chiefly to frankly tuberculous kidneys so proved by operation, autopsy or long continued clinical observation. In fact in a group of 100 cases from the Urological Department of the Massachusetts General Hospital recently studied by us, the tubercle bacillus was not found at all before operation in 14 per cent, diagnosis being made by clinical examination and confirmed later by the pathologist.

In dealing with the apparently healthy kidney one necessarily must exhaust every means of proof that the organ is actually uninvolved. Even under these conditions we find ourselves in agreement with others that the problem is by no means simple. Bumpus (12) states that more than half the subsequent deaths from the disease occur during the first year "probably from disease in the remaining kidney which it was impossible to detect at the time of operation." Casper (14) has advised against operation on an apparently unilateral case until the guinea-pig test has been made and if this is positive, even if the urine from the kidney is pus-free, operation should not be done. Israel (7) takes

the same view. Hyman (7), in a series of 28 cases reported by him says,

> The urine from the opposite, supposedly healthy kidney, was inoculated into pigs. The urinary, cystoscopic findings and smears gave no evidence of disease of these kidneys. Still, in 5 cases (18 per cent) the urine obtained from the opposite kidney by ureteral catheterization gave a positive guinea-pig test. These cases were, however, followed carefully and none developed tuberculosis of the remaining kidney. Undoubtedly, in these cases the bacilli were either carried to the kidney from the bladder urine, through an infected catheter or the contamination was due to a reflux.

Not only do the writers agree to the possibility of these results being due to reflux from the bladder but we find that some observations of André and Grandineau (13) substantiate this view.

We wish also to mention the possibility of the findings being due to a filtration of tubercle bacilli through a healthy kidney. This phenomenon was observed and proved, so far as it is possible to do so, in 5 per cent of our series of cases. That it may and does occur at times, without coincident or subsequent renal involvement has been shown by numerous observers, Brown (9) believing that when it takes place the bacilli are dead; Casper (14) claiming that it occurs only when there is a nephritis of the so-called intact kidney.

In the face of so much conflicting opinion as to the reliability of clinical and laboratory evidence and being desirous of exercising due caution, what is the surgeon to do? As O'Neil (15) says, "The sediment of the sound, or supposedly sound side, should always be carefully examined for pus. If pus is present, the kidney is to be suspected and guinea pigs inoculated. If there is no pus, it may be assumed that there is no renal tuberculosis." In the present series of 100 cases pus was found in the healthy kidney in 28 per cent. There being no demonstrable tuberculosis of these kidneys, the opposite and obviously tuberculous organ was removed in all. While it has been impossible to follow up most of these cases, we know definitely that 6 or 21 per cent have subsequently developed tuberculosis of the remaining kidney.

In contrast to this group, 35 others whose healthy kidney contained no pus whatever are, so far as known, all alive and have no evidence of tuberculosis of the remaining organ.

We find that all writers are in agreement as to the high mortality occurring within the first year after operation. Judd and Scholl (16) report 25.6 per cent of deaths occurring in that period; Bumpus (12) states that "more than half of the subsequent deaths from the disease occur during the first year"; Braasch (17) finds that the late mortality is highest during the first year. We are in accord with Bumpus (12) who says that these deaths are "probably from disease in the remaining kidney which it was impossible to detect at the time of operation."

From our own experience and that of others it seems to be impossible to detect tuberculosis of the kidney in certain instances. We shall not attempt to set a standard by which to go. When, however, the least suspicion of the integrity of an organ is aroused by its local symptoms, the appearances of its ureteric orifice, the presence of leucocytes in its urine or by a retarded and diminished phthalein output then careful and if necessary repeated search for tubercle bacilli should be made. If these organisms are absent the surgeon may then feel that he has done all that is humanly possible, bearing in mind, however, that the final proof will come only with the elapse of time. That many of these cases will eventually develop tuberculosis of the remaining kidney is indisputable. If this unhappy circumstance occurs within a year or two after nephrectomy, who can say whether it was already present at the time of operation or whether it developed subsequent to it. If we believe, as apparently most observers do, that renal tuberculosis is of blood stream origin, then the involvement of both kidneys is not so difficult to understand. On the other hand a review of the evidence in the case makes it easy to understand why the kidney with incipient tuberculosis may so often be regarded as normal.

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TYPHOID INFECTIONS OF THE KIDNEY

FRANK S. PATCH

From the Department of Urology, Montreal General Hospital

According to our present conception, typhoid fever is a blood infection with most intense localization in the intestines, the lymphatic glands and the spleen. It is generally admitted (1) that in 90 to 95 per cent of cases of typhoid fever typhoid bacilli are found in the blood from the second to the fifth day, disappearing ordinarily by the seventh to tenth day, and that typhoid bacilli are found in the urine of 20 to 40 per cent of patients suffering from typhoid fever. It is probable that the conditions in the kidneys favoring typhoid infection in them are no different from those in which other bacilli are presented to them by the blood stream, and if factors lowering renal resistance to infection are present, a typhoid infection of the kidney may result. Blumer (2) found in 10 of the 60 cases of typhoid fever examined, that pyuria was present, a percentage of almost 17. Bacteriologically, in the 10 cases, typhoid bacilli were found twice, once with colon bacilli and once alone. In these cases, it is highly probable that a mild infection had occurred in the renal parenchyma and pelvis. Once a typhoid infection of the kidney has begun, its subsequent course theoretically, will not differ from infections in these organs, caused by other bacilli.

The commonest type of renal infection with B. typhosus is that in which miliary abscesses are found in the renal cortex, a cortical suppurative nephritis, of the type usually regarded as hematogenous in origin. Many of the earlier cases reported were not proved by bacteriological examination. Hölscher (3) in a summary of 2000 autopsies in typhoid fever, performed in the

Munich Pathological Institute from 1854 to 1890, found the following lesions:

Nieren Keile (pyemia)	37
Nieren abscess	3
Pyelitis purulenta	2
Cystitis	2

Flexner (4) reported 2 cases in 1895 on which proper bacteriological examinations were made. In these cases, a large number of abscesses was found in both kidneys, in which typhoid bacilli were found in pure culture. Death had occurred on the twenty-second and forty-seventh days of the typhoid fever.

Flexner (5) in a second article, pointed out how frequently the typhoid bacillus had been found in the kidneys by culture method, both where no lesions had been detected, and in association with lymphomata. He gave a very minute description of the infective process in the kidneys obtained at autopsy. The miliary abscesses appeared in two groups, smaller ones limited to the cortex, and larger ones in the medullary as well as in the cortical regions. The latter were of the type of radiating nephritis. The intertubular infiltration diminished downwards into the pyramids. The cortical lesions showed a central zone of pus cells, surrounded by a zone of round celled infiltration, large masses of typhoid bacilli being found in the lesions. The tubules were dilated and filled with pus cells, and often with masses of bacteria, and their epithelium was swollen, granular, and often degenerated. In the infiltrated areas, masses or emboli of bacteria were seen in the afferent vessels, in the glomerular capillaries and in the capillary spaces. In Flexner's opinion there seemed no doubt that the bacilli gained entrance to the tubules through the glomerular capillaries, a confirmatory sign being the absence of the bacilli from the intertubular tissues. In his opinion, there was no doubt as to the etiological connection between the organism and the pathological process, and to the hemotogenous route of invasion.

Srba (6), quoted from Melchior (7), found "embolic kidney abscesses in two cases, in which typhoid bacilli were found in pure culture." Sheib (8) reported 2 similar cases. The first

case, dying on the twenty-first day of illness, presented clinical signs of enteritis, cystitis and nephritis. The autopsy showed both kidneys to be greatly enlarged, and the renal cortex to be studded with numerous small abscesses containing typhoid bacilli. The mucosa of the pelves of the kidney, and of the bladder was slightly reddened. The second case, dying on the twenty-eighth day of typhoid, had complained on admission of having suffered from a floating kidney. At autopsy, there was found a pyonephrosis with numerous abscesses in the cortex of the kidney. The other kidney was normal. A mixed infection of B. typhosus and B. coli was found in this case, which constitutes an exception to the usual type, in that the process was unilateral. The mucosa of the pelvis and upper third of the ureter of the involved kidney was slightly reddened.

Campbell and Rhea (9) reported from this clinic a case of bilateral renal infection, occurring in the course of typhoid fever, in which a mixed culture of B. typhosus and B. coli was obtained from both kidneys by ureteral catheterization. Autopsy showed a bilateral subacute infective nephritis with an acute purulent infla nmation engrafted upon it. The cystitis was noted as being of mild grade. In this case, occurring in 1907, the diagnosis was made ante-mortem, by bilateral ureteral catheterization. All the cases previously mentioned have been autopsy findings.

One case of a large solitary typhoid kidney abscess, has been reported by Troisier (10). The case, during convalescence from typhoid, died of meningitis. At the autopsy, a solitary kidney abscess was found, in the pus from which B. typhosus was grown in pure culture. Such large solitary abscesses are commonly considered to be due to the confluence of several small miliary abscesses.

Several clinical reports have been made upon the subject of typhoid pyelitis by Comba (11), Brownlee and Chapman (12) (5 cases) and Eckert (13). In none of these cases was modern urological methods of examination used, and from the information available it would seem more likely that the diagnosis of pyelonephritis was the more correct one, and that they were clinical manifestations of cortical suppurative nephritis. A haematog-

enous pyelitis during an acute infectious disease is now generally regarded as the exception, the pyelitis being a metastatic infection from a primary nephritis.

Vozza (14) has more recently reported a case of bilateral pyelonephritis in the 7th month of pregnancy. The patient had intermittent fever with a preceding chill. Typhoid bacilli were found in the urine and in the blood following a chill. Abortion was followed by recovery. The bacteriuria persisted for thirty days longer.

Mackenzie (15) states that typhoid bacilli were found in 2 out of 200 cases of pyelonephritis, in which cultures were obtained by ureteral catheterization. Writing at a later date (16), he reported that in 468 urethral catheterizations B. typhosus was found once, and B. paratyhposus on three occasions.

From Mackenzie's detailed reports and from the frequent reference in text books to B. typhosus as a microörganism in infections of the urinary tract it is probable that the organism is the cause of more renal infections than has been generally believed.

It is quite possible that some of the cases reported as typhoid cystitis may have been secondary to a primary pyelonephritis. Certainly in none of the cases reported was the presence of a renal infection excluded by a complete urological examination, including catheterization of the ureters.

Houston's (17) case was interesting in that there was no history of an attack of typhoid fever. A woman, aged thirty-five, had nursed a child with an intestinal malady from which it succumbed. She remained well, but soon afterwards began to have painful urination. This increased, accompanied by frequency. The urine contained B. typhosus, and she had a positive Widal reaction. The diagnosis of a cystitis was made, apparently on subjective signs only. One frequently sees pyelonephritides, entirely silent in the renal area, but with very marked subjective and objective vesical symptoms.

The case of Brown (18) had typhoid fever thirty-five years previously. From that date to her entrance to hospital for a gynecological operation, she had nothing suggesting a reinfection with typhoid, or a latent infection in the form of bone

lesions. She had never had painful or difficult micturition. On the day of operation the urine contained no pus cells. The operation, a difficult one, involved considerable handling of the bladder, and possible trauma. On the eighth day after operation, she had a rise of temperature to 100°, and for the next ten days, acute vesical pain, tenesmus, frequent and painful micturition with much pyuria. A cystoscopic examination showed a universally congested mucous membrane. Ureteral catheterization was not employed. B. typhosus was grown in pure culture from the bladder urine. Brown considered that typhoid bacilli had been introduced by a urethral catheter, though none of the nurses in attendance had recently been nursing typhoid patients. He suggested as a predisposing factor the inevitable vesical trauma at the operation. He did not mention whether the catheter was used for the retention of urine or not. The author referred to the possibility of the typhoid infection arising in a latent focus, but discarded this source from consideration. At the time when he wrote, "the longest time subsequent to typhoid infection, in which the bacilli remained latent, was some seven or eight years." Since that date, cases of latent infection for much longer periods have been noted, one in this hospital, of twenty-six years.

We may, by a fairly plausible reasoning, regard the pyuria which according to Blumer (2) "occurs fairly frequently in typhoid fever, and is a complication of no gravity," as due to a mild pyelonephritis, though it must be noted that Blumer suggested the possibility of the bacilli gaining access to the bladder from the intestinal tract by penetrating the recto-vesical wall.

TYPHOID PERINEPHRITIC ABSCESS

Several reports of this condition were prior to the era of bacteriological examination. Among them were a bilateral case of Rosenstein (19) and one of Rosenberger (20). Kuster (21) found in 230 cases of perinephritis, typhoid as the cause of 6. The case of Stinelli (22) was confirmed by bacteriological examination. A patient, in his typhoid delirium, threw himself out of bed, and struck his left loin. During his convalescence a perinephritic abscess developed. This was drained and typhoid

bacilli were grown in pure culture from the pus. The urine had been clear, but the kidney was enlarged. A primary focus in the kidney was not looked for. The case of Haushalter (23) was almost identical with Stinelli's. In this case, pus was present in the urine. No communication between the kidney and the abscess was discovered. The case of Johnson (24), twelve weeks after typhoid, had pyuria, but the kidney was not felt. It is quite in keeping with our present views of the pathogenesis of this condition to regard it as originating in a cortical suppuration of the kidney, conveyed by perforation of the renal capsule, or through lymphatic intermediaries. The possibility of a splenic abscess infecting the perinephritic space is mentioned by Melchior from a consideration of the case of Harrington (25).

Eight cases of pyonephrosis have been reported, to which we shall add 2 cases arising in this clinic. These will be reported more fully:

Case of Garnier and Lardennois (26)

A man, aged thirty-one, during convalescence from an attack of typhoid of moderate severity, suddenly developed a temperature of 40°, with pain in the left hypochondrium. This had been present earlier in the typhoid and had been attributed to perisplenitis. The temperature fell to normal, but the pain persisted. One month later he complained of pains in the left lumbar region radiating to the left testicle, resembling a renal colic. The attack ended with the passage of clots of pus in the urines, from which B. typhosus was isolated in pure culture. These attacks recurred, accompanied by rises of temperature. Two months later a nephrotomy was performed and a small abscess in the convexity of the kidney was incised. In spite of this, pyuria persisted with moderate intermittent temperature. Four months after the nephrotomy, the left kidney was removed. The kidney was enlarged, nodular, and riddled with abscesses. The patient's condition did not improve, however. Right-sided pain continued, with chills and intermittent temperature, and death ensued four months after the nephrectomy. The right kidney was very large, its surface irregular, with prominences corresponding to pus-filled cavities beneath. These cavities varied from the size of a pea to that of a walnut. Both kidneys showed the picture of multilocular pyonephroses.

In this case the pyonephroses had formed as a result of a cortical suppurative pyelonephritis.

Two cases are mentioned by Melchior (7), the details of which were not available to him, viz.: Wagner, who once found typhoid bacilli in a pyonephrosis after a severe abdominal typhoid and Karewski who removed a pyonephrotic kidney, the result of typhoid fever fourteen years previously.

The following 2 cases illustrate the infection with typhoid bacilli of previously existing hydronephroses:

Case of Fernet and Papillon (27)

A twenty-six-year-old man complained, on the thirteenth day of his typhoid fever, of pain in his left flank. Although the patient's temperature had almost reached normal his general condition was worse. An elastic swelling was noted in the left hypochondrium, distinct from the spleen and extending into the kidney region. A diagnosis of retroperitoneal abscess was made, and incision was made on the twenty-fifth day, transperitoneally. One liter of pus was evacuated. The patient died of general peritonitis two weeks later. The urine was never purulent and at no time did the patient complain of urinary symptoms. Autopsy revealed the fact that the incision had been into a distended pelvis through very thin renal substance. The kidney was very large and one of the several abscesses in the parenchyma communicated with the pelvis. The ureter was narrowed and bent sharply, the whole picture being that of an intermittent hydronephrosis. Typhoid bacilli were obtained in pure culture, from the pus obtained at the operation and at post mortem from abscesses in the kidney which did not communicate with the pelvis.

Case of Meyer and Ahreiner (28)

This was a case of secondary infection with typhoid bacilli of a pyonephrosis previously infected with B. coli. A young girl had suffered an illness, at the age of sixteen, when a diagnosis of pyonephrosis, caused by B. coli was made. One year later she contracted typhoid. From that date the urine was always cloudy and a tumor in the left kidney region was present. Pains were only noted eight months before the operation of transperitoneal nephrectomy, nine years after the typhoid fever. At this time there was an elastic tumor, renal in type and of

considerable size. The urine was acid, and contained much pus. From the kidney pelvis after the operation, typhoid bacilli were obtained in pure culture.

Rovsing (29) in 1897 reported the case of a man fifty-three years of age, who contracted typhoid fever one and one-half years previously. During his convalescence he noted his urine was very cloudy. Some months later he began to have severe vesical pain and great frequency of urination with severe tenesmus. The urine obtained by catheter contained typhoid bacilli in pure culture. Cystoscopic examination was attempted without success, the bladder being very contracted. Both kidneys were palpably enlarged. For relief of the pains, a cystostomy was performed. A severe cystitis was noted, with pus coming from both ureters. Death occurred one month later. The right kidney was found to be much enlarged and converted into a pus sac. Its pelvis contained a large stone, composed of urates and calcium oxalates, the size of a walnut. Numerous small abscesses were scattered throughout the renal parenchyma. The mucosa of the pelvis and ureter was inflamed and ulcerated. The left kidney showed a similar condition though of less degree, with numerous small abscesses in the cortex. The pelvis and ureter were not inflamed. No stone was present. The bladder showed a severe ulcerative cystitis. Both Rovsing and Melchior in discussing the case were of the opinion that the stone had been present before the typhoid fever, and that its presence had predisposed to subsequent infection of the kidney with the typhoid bacillus. To us it has seemed just as reasonable, as it did to H. H. Young (30) in discussing the case in 1900, to assume that the calculus was secondary to the infection. It is interesting to note that Rovsing (31) in 1923, in reporting the results of bacteriological examinations in 589 cases of renal calculus, found B. typhosus present in 3 cases.

A similar case was reported by Greaves (32) in 1907.

A thirty-five-year-old man had an attack of typhoid more than six years previously. During his illness, he had occasional difficulty in passing urine and had apparently passed pus. This had occurred

occasionally subsequently. Four months before his coming under Greave's care he had pain in the left loin, radiating to the groin. For the last two weeks swelling in the left loin was noted. On admission, he was weak, and presented a large tender tumor in the left loin, apparently renal. Urine was clear. Cystoscopy showed a normal bladder, though no urine was observed coming from the left ureter. Operation revealed a large pyonephrotic kidney. Pus was aspirated and, after enlarging the opening, a large stone was extracted from the ureter. Drainage. Uninterrupted recovery. The stone was phosphatic with an oxalate nucleus. The pus aspirated from the kidney contained B. typhosus in pure culture.

Greaves regarded the calculus as secondary to the renal infection. Melchior in his discussion of the case took the contrary view.

Cases of H. H. Young and Lehr (*2*) (33)

Case 1. The condition, in a man of forty-four, had persisted for eight years after an attack of typhoid fever. During the attack the right testicle was inflamed. No urinary disturbance during the fever was noted. He never completely recovered his strength, and frequently had a fever of low grade. One year later he noticed that his urine was thick and cloudy. Pains in the back and headache gradually became more severe and were associated with slight irritation in the bladder, without increased frequency. He had frequent febrile paroxysms and lost considerable weight and strength. Seven years after the typhoid, a mass was discovered in the left side. At first thought to be splenic, it was not until he was referred to Young, that its true nature was discovered. The urine was loaded with pus. The diagnosis of pyonephrosis was confirmed by cystoscopic examination. Owing to the weakness of the patient a nephrotomy was performed under local anesthesia. A large perinephritic abscess was discovered. In the perinephritic abscess was found a stone 1 cm. in diameter, and in the pyonephrotic kidney a large, irregular mass of calculous debris. From the center of this stone, B. typhosus was grown. Before incising the kidney, pus was aspirated from it, which later proved to contain typhoid bacilli in pure culture. The patient's condition was greatly improved by the renal drainage, but fifteen months later, a nephrectomy had to be performed, followed by perfect recovery. The kidney was almost completely destroyed and replaced by many abscess cavities. The pelvis was completely filled by a large stone.

Case 2. A case of double pyonephrosis ten years after typhoid. This had been previously reported by Young (34) under the title of "chronic cystitis due to the typhoid bacillus." The patient had typhoid in 1893 at the age of thirty-two. During this attack he had pain on urination, increased nocturnal frequency and pyuria. For the next four years, he had constantly passed milky urine. He returned to the hospital having contracted gonorrhea. Early in 1898, urine obtained from the bladder by aspiration gave a growth of B. typhosus. Widal reaction was positive. In 1900, he again returned to hospital with gonorrhea; again the urine showed B. typhosus. On this admission a cystoscopic examination was made. The bladder was chronically inflamed, congested, red, with numerous small ulcerations. The trigone presented a granular appearance. The ureteral orifices were markedly congested. The patient had an evening rise of temperature but was free from subjective urinary symptoms. A second cystoscopic examination showed practically the same vesical condition. On this occasion jets of clear urine were observed coming from the right ureter. The flow from the left could not be satisfactorily studied. No improvement could be effected under treatment. Three years later he was again admitted to hospital, and died eight days later. There was tenderness over both kidneys, and the patient became uremic before death. Autopsy showed both kidneys to be large. The left kidney had dilated calices in its upper half, filled with concretions the largest of which was 7 by 5 cm. In the lower pole, there was one cyst filled with thick creamy pus. The right kidney had practically no cortex left, and consisted of pockets, containing thick creamy pus. One large stone, 3 by 2 cm., lay in the pelvis. The calices contained numerous small stones. Both ureters were much dilated, most markedly above the brim of the pelvis. Their walls were thickened and congested. The bladder was contracted and showed a marked thickening of its walls. The mucosa of the trigone and the base of the bladder was roughened and granular, and markedly congested, especially about the ureteral orifices. Cultures from the pus obtained at the autopsy showed B. typhosus. From the center of the stone, the proteus bacillus was isolated.

Young was of the opinion that the cystitis was primary, and that the double pyonephrosis had developed in the interval between the last two admissions to hospital.

The case of Melchior (35) was a typhoid infection of an inter-

mittent hydronephrosis resembling the cases of Fernet and Papillon, and of Meyer and Ahreiner.

A male, aged twenty-seven, had always been healthy except that as a schoolboy he had once suffered from a transient tumor in the right side of the abdomen. About one month after a mild attack of typhoid, which was not diagnosed as such, he was suddenly seized with severe pains in the right side of the abdomen. An extensive mass was made out. This was punctured, and 9.5 liters of a purulent fluid were removed. The temperature remained high, the pus reaccumulated. There were no subjective urinary symptoms and the urine remained clear. A diagnosis of closed pyonephrosis was made. Operation showed that the previous puncture had been transperitoneal, and disclosed a large pyonephrotic kidney, from which 6 liters of a thin, purulent and odorless fluid were evacuated. From this pus, B. typhosus was grown in pure culture. The kidney was removed, but the patient died of general peritonitis four days later. The extirpated kidney had no visible renal parenchyma. This was replaced by a series of large cysts. The ureter was concentrically narrowed at its junction with the pelvis, so that only a fine probe would pass. The left kidney was enlarged; its cortex was sprinkled with small abscesses, and was ill differentiated from the medulla. Its pelvis and ureter were normal. The bladder was inflamed, and in spots covered with a fibrinous exudate.

To these cases we desire to add 2 cases of pyonephrosis due to B. typhosus.

Case 1. Western Division, No. 807–1924. Mrs. U. T., aged forty-seven, married. Admitted to the Western Division of the Montreal General Hospital, June 5, 1924, complaining of pain in the left side and frequency of urination. Pain began two years previously. It was situated in the left loin, radiating downwards and forwards to the pubes. Pain, which was intermittent, gradually increased in severity, until morphine was usually required during the attacks. In the two months before admission, the pain was more frequent, more severe and lasted longer. More recently she had begun to have frequency, every fifteen minutes by day, and two to three times at night. Three weeks previous to admission she had passed "gravel," with some bloody mucus. She further stated that she sometimes passed large quantities of water, when her symptoms were greatly relieved.

Personal history. Measles in early life. Married, six children. Has never had typhoid fever.

Family history. Negative.

Present condition. Examination revealed no abnormality, except a vaguely outlined mass palpable in the left renal region, rounded and smooth. There was tenderness on deep pressure in the left costo-muscular angle and at the tip of the twelfth rib in front.

Urine. Cloudy: acid: 1014; albumin ++: pus cells ++: bacilli, no tubercle bacilli.

X-rays. The left kidney shadow was markedly enlarged, the lower pole reaching almost to the level of the crest of the ilium. Within this shadow were seen 6 shadows of increased density, the largest being 2.5 cm. in diameter, the others varying from 1 to 2 cm. Scattered between these shadows were several fine shadows.

Cystoscopic examination. June 9. Marked relaxation of vaginal outlet, cystocele and rectocele, urethra patulous. Bladder pale, much débris floating about, not inflamed. Ureters normal, readily catheterized. A free flow of normally colored and clear urine was obtained from the right. The left yielded a scanty flow of pale urine. These specimens were lost. Phthalein injected intravenously, appeared on the right side in three minutes, but on the left side no color in fifteen minutes.

Cystoscopic examination. Repeated June 12. Specimens obtained from both kidneys. The flow from the left was much freer than from the right.

	RIGHT	COMMON	LEFT
	Clear	Turbid	Cloudy
	Acid	Acid	Acid
Albumin	0	++	+
Pus	0	++	+
Culture	Negative	−	B. typhosus
Phenolosuphonephthalein	4½ minutes	−	7 minutes

Sixteen cubic centimeters sodium iodide 12 per cent were injected up the left ureter and a pyelogram taken.

Pyelograms. Left kidney showed marked dilatation of the pelvis and calices, and apparently a definite constriction at the uretero-pelvic junction. Below this, opposite the transverse process of the fifth lumbar vertebra, there was a small dilatation suggestive of constriction. With

the ureteral catheter withdrawn almost to the ureteral orifice in the bladder a dilatation was noted at its lower extremity.

Diagnosis. Pyonephrosis, left, B. typhosus, nephrolithiasis, ureteral strictures.

Operation. June 16. Left nephrectomy, lumbar, extra peritoneal, under ether anesthesia. The kidney was large, soft, flabby and cystic, and closely adherent to the surrounding fat capsule. In separating it, the finger, incautiously broke through the thin wall of a sac, liberating

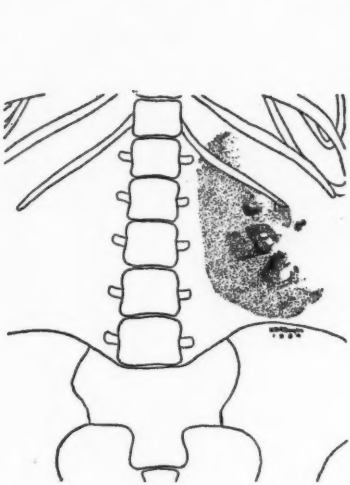

FIG. 1

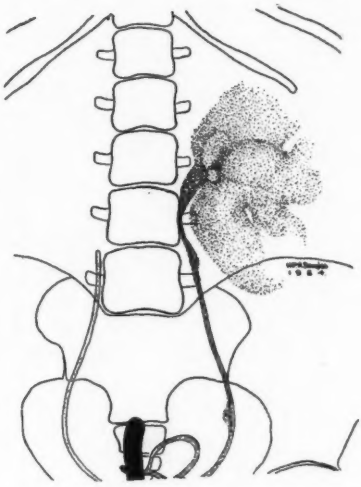

FIG. 2

FIG. 1. CASE 1. DIAGRAMMATIC REPRODUCTION OF X-RAY

Note large kidney shadow which contained shadows of increased density, representing calcareous débris.

FIG. 2. CASE 1. DIAGRAMMATIC REPRODUCTION OF PYELOGRAM

thin, foul smelling pelvic contents. The ureter was embedded in periureteral adhesions and 10 cm. of it were removed with the kidney, so as to include two definitely constricted areas. Post-operative slight wound infection. The urine gradually cleared, though slightly purulent on discharge. Widal reaction was positive on June 25, 1924. Bacteriological examination of the urine on July 5, 1924, showed B. typhosus to have disappeared. Discharge twenty-seven days after operation, wound completely healed.

Pathological report. (Dr. L. J. Rhea.) "Specimen consists of a greatly enlarged left kidney, with 10 cm. of ureter attached. Before any detailed examination is made, the pelvis and the dilated calices are tapped with a sterile syringe, in order that a bacteriological examination could be made. The material removed was of a thin, greyish, purulent character, containing great numbers of tiny calcareous masses, which had the general appearance of sand. The collapsed pelvis is

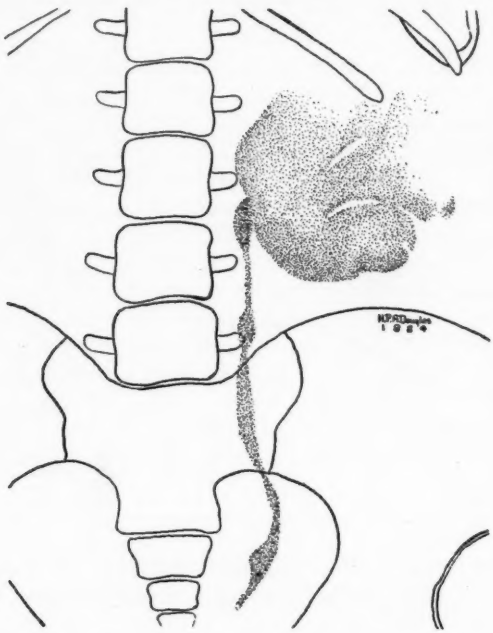

FIG. 3. CASE 1. DIAGRAMMATIC REPRODUCTION OF URETERO-PYELOGRAM
Note constrictions and dilatations

filled with fluid to its maximum content without stretching it. When this is done, the surfaces of the kidney are grossly irregular, due to elevated, tense, fluctuating, semi-hemispherical areas, separated by deep depressions. There is considerable fat, firmly united by fibrinous adhesions to the kidney capsule. The pelvis is very large, fluctuates, and fatty tissue is firmly adherent. There are two very definite con-

strictions in the ureter; one 2 cm., the other 4 cm. from the juncture of the ureter with the pelvis. Fatty tissue is adherent to the ureter.

"An incision through the parenchyma of the kidney in its long axis, shows the following: The parenchyma is very definitely thinned out, especially over the dilated calices, is pale, and its normal gross anatomical markings obscured. There are no abscesses in the kidney parenchyma. The calices are widely dilated. Their communication

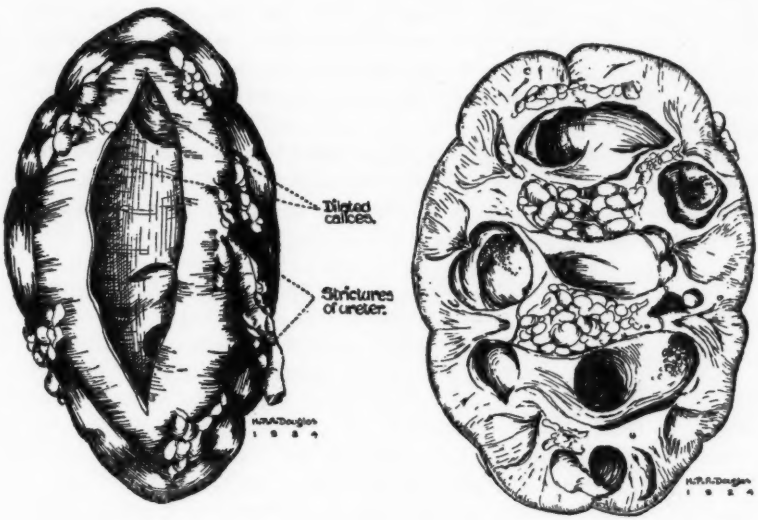

FIG. 4 FIG. 5

FIG. 4. CASE 1. POSTERIOR VIEW OF SPECIMEN
Dilated pelvis incised

FIG. 5. CASE 1. SPECIMEN. INCISED THROUGH POSTERIOR BORDER OF KIDNEY.
PELVIS LAID OPEN

with the pelvis appears as large round orifices. In one dilated calyx there is a round calcareous mass, 1 cm. in diameter, which is easily broken up into its component parts, when it is found to consist of great numbers of tiny calcareous masses loosely bound together. A small amount of fibrin, intermingled with fine, sand like, calcareous material is adherent to the surface of the calices.

"There are no acute ulcers.

"The kidney pelvis is widely dilated, is regular in outline, and its walls are very thin. Its mucous surface is similar to that of the dilated calices. No acute ulcers are present.

"There is a narrow, sharply outlined constricted area, in the ureter, 2 cm. below the ureteral orifice. Above this stricture the ureter is widely dilated, and really forms a part of the distended pelvis. This constricted area is quite firm. There is a second elongated area of constriction, 2 cm. below the constriction just described. This constricted area is also firm. A small probe can be passed with ease through both of the constricted areas in the ureter, but they are dilated with difficulty. Between the two constrictions, the ureter is definitely dilated. There is no dilatation of the ureter below the second constriction.

"Cultures were made from the pelvic content, and from the distended calices. Besides the routine laboratory media, a series of endo-plates was inoculated. From all of the cultures B. typhosus was obtained in pure culture."

Case 2. M. G. H., 385, 1921. L. S., aged thirty-two, male, unmarried, Polish laborer, admitted January 26, 1921.

Complaints. (*a*) Pain left side running down left thigh; (*b*) weakness.

Personal history. Born in Poland, has lived in Canada for fourteen years. Typhoid fever in 1911; ill for nine weeks, and again in the summer of 1920. Has not worked since. Denied venereal diseases.

Present illness. Has not been perfectly well since he had typhoid fever in the summer of 1920. Was in the hospital in the "North Country" for nine weeks. On his discharge he came to Montreal and commenced work. After two weeks he was forced to discontinue on account of pain in the sacro-iliac region, December 18, 1920. Pain which was described as of a "squeezing" character, more marked on the left side, began in the costomuscular regions and passed downwards to the inguinal rings and down the posterio-lateral surface of the thigh. Recently, he had found his legs weak. Urination not altered, though he got up once at night.

Previous to admission to the ward, he was under observation for twelve days in the Out-door Department.

Condition on admission. Temperature 102; pulse 96. Patient a well nourished male of stated age, is forced to assume recumbent position on account of pain in the sacro-iliac joints. Tongue coated heavily; teeth very dirty and carious, a number of roots require extrac-

tion. Lungs normal; blood pressure, systolic, 130, diastolic, 80, aortic second sound accentuated. Abdomen is negative, no masses palpable, no points of tenderness. There is tenderness over both sacro-iliac joints with pain on movement.

Urinalysis. Specific gravity 1017; neutral reaction; turbid; albumin +; microscopically, pus cells +; few blood discs.

X-rays of the urinary tract are negative for calculus.

Wassermann is negative. Blood urea nitrogen, 14 mgm. per 100 cc.

Blood examination. Red blood cells 3,648,000; white blood cells 10,000; hemoglobin 72 per cent.

Cystoscopic examination. January 28, 1921. No. 24 F. scope easily enters the bladder, which is normal. Ureters easily catheterized. Turbid urine obtained from the right, clear urine from the left. Flow from both sides is capricious, examination therefore unsatisfactory. The right urine shows copious pus, the left side showing no pus.

Culture was negative. Ten cubic centimeters of thorium were injected into each kidney pelvis. Pyelogram on the left side was normal. On the right side it showed four roughly quadrilateral shadows, varying in size from that of 1 to 2.5 cm. in diameter. Cystoscopic examination was repeated on February 1, 1921.

Ureters catheterized. Flow from the right side was continuous for the first five minutes. Quantity three times that from the left side. Specimens of urine were taken for urinalysis and culture. Detailed urinalysis follows:

	COMMON	RIGHT	LEFT
Color	Amber	Light amber	Amber
Specific gravity	Cloudy	Turbid	Slightly turbid
	1022	—	—
	Acid	Acid	Acid
Albumin	Trace	Trace	Trace
Urea	—	0.8 per cent	1.8 per cent
Phenolsulphonephthalein, 5 minutes	—	5 per cent	9 per cent
Microscopy	Pus +	Pus ++	
	Epithelium	Epithelium	Epithelium
Culture	B. typhosus	B typhosus	

No acid fast bacilli found.

Bacteriological report. (Dr. L. J. Rhea.) "Right shows a number of colonies. Common, numerous colonies. From each of above B.

typhosus was recovered. The organisms have been identified by their cultural reactions on endo-media, sugars and their morphology, staining reactions, and motility."

A diagnosis of pyonephrosis, right kidney, due to bacillus typhosus was made.

Right nephrectomy (February 28, 1921) was carried out under ether anesthesia. The kidney was placed high under the ribs, and bound down by fairly tough adhesions. Adhesions were also marked about the pedicle of the pelvis and ureter. In removing the kidney the soft upper pole was slightly lacerated. The adhesions about the ileum and about the pelvis and ureter were separated after some difficulty and the kidney removed. The pelvis was capacious and bulging.

Pathological report. (Dr. L. J. Rhea.) "A kidney with pelvis and small portion of ureter weighing 220 grams. The external surface of the pelvis is covered with fat tissue, which is increased. The surface of the kidney is brownish red and smooth in the lower two thirds. The upper third had a congested, lobulated appearance, which is most marked on the posterior surface. At the tip of the lower pole and also on its posterior surface, are several slightly depressed areas which are deep red. On palpation the lower two thirds is of normal consistency. In the upper third the lobulated areas are moderately firm and cortex feels thin. Section through the pelvis shows the lower main branch of the pelvis to be normal in size, 1.5 cm. in diameter, while the upper main branch is only 5 cm. in diameter.

"The walls of the pelvis are smooth and glistening. A longitudinal section through the kidney shows, in the lower two thirds, what appears grossly to be normal kidney tissue. The markings are fairly well defined, the calices are not dilated, and the cortex is 7 mm. thick. In the upper third the kidney tissue is very thin, 5 mm. in thickness, and the calices which drain this area, and empty into the upper branch of the pelvis, are markedly dilated, 1.5 to 2.5 cm. in diameter. The lining of these calices is for the most part smooth, but in one there is a definite puckering of the lining which is due to scar formation in the kidney substance and contraction. Section through the depressed areas, shows the depression to be caused by scarring and a pulling in of the capsule. From the center of the depression, fine radiating lines of hemorrhage pass down through the cortex, to the medulla.

"In the upper pole of the kidney there are four cystic areas. Three of them communicate and empty, in common, into the upper pole of the pelvis. The fourth has a separate entrance. The gross character of the

cysts is not the same throughout their entire wall. As the pelvis is approached, the lining of the cysts becomes thicker, paler, firmer, and assumes more and more, the gross character of the pelvis itself.

"Cultures from the cystic areas show B. typhosus in pure culture."

The wound became infected with staphylococcus aureus and considerable time elapsed before it was entirely closed. He was discharged from hospital on April 6, well, without complaints of any pain.

DISCUSSION

In both our cases the disease was unilateral. This unilaterality has been noted in only four other of the cases referred to, viz., Young and Lehr's first case, Greaves', Meyer and Ahreiner's, and one of Sheib's. It is possible that in both our cases, the initial infection may have been bilateral.

There is nothing to indicate the exact time of onset in either of our cases. In the first case, there was no history of an attack of typhoid. She may have been a typhoid carrier, in the gall bladder or in the intestine. Infection in the kidney may at any time have been precipitated by any localizing incident in the kidney. In the second case, there is nothing in the case history to indicate when the renal infection began. It may have been contracted in either of the attacks of typhoid in 1911 and 1920. The symptoms which brought him to hospital were those due to his rheumatoid infection. The pyuria which was discovered on his admission to hospital may have been present for a considerable period of time. No tumor was present.

Masses of calculi were found scattered in the calices of the first case. Such concrements, or actual calculi have been found in the cases of Rovsing, Greaves and Young. Melchior and Rovsing were both of the opinion that in such cases we have to deal with secondary infection with typhoid, of kidneys previously the sites of calculus formation. One of Young's cases, in which the proteus bacillus was isolated from the centre of the stone, would seem to favor this hypothesis. If we accept it, infection with typhoid of such a kidney is very reasonable. There is ground, however, for believing that in some of the cases the calculus formation was secondary to the infection. This was

certainly so in the case of Young, in which typhoid bacilli were isolated from the nucleus of the stone. We regard it as probable in our case.

Melchior is rather insistent that most of the cases of pyonephrosis collected by him, which did not include those of Young and Lehr, were the result of infection of kidneys previously diseased either with stone or hydronephrosis. In three of the reported cases, those of Fernet and Papillon, Meyer and Ahreiner and of Melchior, a hydronephrosis may have been present. Infection of such a kidney during the course of typhoid would be comparatively simple. In the case of Garnier and Lardennois and of Sheib the pyonephrosis followed definitely upon a primary pyelonephritis. In both of our cases there was nothing to show that this was not the course of events.

The strictures of the ureter present in our first case would undoubtedly have been regarded by Melchior as preëxisting to the typhoid infection. In the absence of any confirmatory evidence in the case history, it is equally reasonable to ascribe them to ureteritis secondary to the initial pyelonephritis. Their presence must have played a considerable rôle in the production and continuation of the pyonephrosis.

RENAL TYPHOID

In our first case there was an absence of a history of an attack of typhoid fever. There arises the possibility of a primary renal infection with the typhoid bacillus. Numerous cases are reported of atypical forms of typhoid infection without intestinal lesions, especially by A. Posselt (36) and Flexner (37) Posselt, in dealing with the possibility of a primary typhoid infection, i.e., one where the process was limited entirely to the kidney, with absence of all intestinal symptoms, found after a thorough search of the literature, only one authenticated case with entire absence of intestinal symptoms. This was the case of Vanzetti (38), a fifteen-year-old girl who suffered from a severe parenchymatous nephritis, with definite uremic symptoms. Autopsy showed the spleen to be normal, and no changes of any kind in the bowel. From the kidneys pure cultures of B. typho-

sus were grown. There were infarcts with numerous typhoid bacilli.

The portal of entry of the bacilli in such cases has been discussed by Flexner (37). He thought it possible for bacilli to pass through the intestinal walls without leaving any traces of their passage. He also suggested the possibility of the bacilli entering the blood stream through intestinal lesions previously present, as for example, through tuberculous ulcers, a mode of entrance reported in a number of cases of typhoid septicemia. He referred to the possibility of air infection, by way of mouth, throat, or respiratory passages.

One must, however, in viewing our case and that of Houston as primary renal typhoid infections, bear in mind the possibility of the renal infection being secondary to an original general infection, with symptoms so slight and transient as caused them to be overlooked. Flexner (37) quoted Rokitansky as pointing out that the changes produced in the intestine were sometimes so insignificant that it required the closest inspection to discover them. Whiting (39) has recently shown in a study of 50 cases of typhoid in infancy and childhood how very mild typhoid fever may be in young children. Temporary or permanent urinary carriers are not uncommonly found in children.

CONCLUSIONS

In the light of our present knowledge of the subject, typhoid infections of the kidney are more common than has been generally believed. We must regard them as of hemotogenous origin. In many instances the bacilli are excreted without producing any obvious infection, or but a mild and transient pyuria, which is probably the evidence of a mild renal infection. Infection of the kidney will be favored, and its course influenced by pre-existing accessory factors embarrassing the kidney and its drainage, such as trauma, stone, or hydronephrosis. The accessory factor may not be evident, sagging kidney, etc.

Pathologically, kidney infection, usually bilateral, takes the form of cortical and intertubular suppurative processes in the kidney parenchyma, with pyelitis, and occasionally ureteritis, cys-

titis and perinephritic abscess. The production of miliary abscesses has been common in the acute, fatal cases, with the production of pyonephrosis in a few. Those cases which survive the infection for any length of time show the picture of a multilocular pyonephrosis, with occasional stone formation. Multiple ureteral strictures have been noted in one case.

The onset of infection may be during the fever, convalescence or at a later date. The course of the infection may be very acute. If the patient survives it may be very chronic.

Recovery has been noted in only 5 of the cases of pyonephrosis, all unilateral and following operation (Young, Meyer and Ahreiner, Greaves, and our 2 cases).

The symptomatology in no way differs from that of other renal infections.

The diagnosis should offer no difficulties if modern methods of urological examination are used.

The treatment is that of other renal infections, and requires no special comment.

Epidemiologically, individuals with acute and chronic typhoid infection of the urinary tract are typhoid carriers, and are even more dangerous to the community than gall bladder or typhoid carriers.

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PYELONEPHRITIS

GEORGE R. LIVERMORE

Memphis, Tennessee

I believe pyelitis per se to be a rare condition. Keyes (1) states that acute pyelitis does not occur without suppurative nephritis, but that the lesions in the pelvis may predominate. This view seems to be borne out by the experiments of Helmholz (2).

I wish to discuss the subject under the following heads: (*a*) Pyelonephritis of childhood, (*b*) pyelonephritis of pregnancy, (*c*) pyelonephritis following operation (especially those cases in which the patient has been catheterized for retention), (*d*) pyelonephritis of stasis, (*e*) pyelonephritis of overwhelming bacterial invasion or diminished kidney resistance.

PYELONEPHRITIS OF CHILDHOOD

Pyelonephritis of childhood has not received the attention and careful study that its seriousness demands. In the treatment of many permanently damaged kidneys whose history dated back to some urinary disturbance in childhood, with chills and fever and treated as malaria or only by internal medication, or in addition removal of tonsils. I am convinced that had these patients received a complete urological examination with pelvic lavage and elimination of the focus of infection, all future trouble would have been avoided or greatly minimized. Most physicians are prone to treat all kidney infections of childhood with alkalies and large amounts of water, because the acute symptoms will subside in the great majority of cases under this treatment, but because the chills, fever and sweats are eliminated, is not positive evidence that the child is cured. It has been my experience that except in the acute stages, kidney infections are most insiduous and the lesions far out of proportion to the symptoms manifested.

A case of mine in which both ureters were distorted, tortuous tubes almost the size of the index finger, with markedly hydronephrotic kidneys whose combined phthaleine output was only 15 per cent, was a remarkably well developed, fine looking child, who had recently withstood a rather severe attack of measles.

The focus of infection in these cases is usually the tonsils or colon, but may come from infection anywhere in the body and should the kidney (which as you know can remain healthy, despite the filtration of pyogenic organisms), become damaged, e.g., toxines, trauma, etc., or the supply of bacteria be increased; e.g., acute tonsilitis or otitis media, infection of the kidney is sure to result. Also should there be a movable kidney, stricture or kinked ureter, stasis will soon make it a fertile field for involvement. It is surprising how rapidly most of these little patients will clear up under cystoscopy and pelvic lavage. Although a delicate procedure, it can be accomplished with about the same precision and result as in the adult.

PYELONEPHRITIS OF PREGNANCY

Pyelonephritis of pregnancy is of far more frequent occurrence than is usually taught and many cases are treated as nephritis, because albumin is found in the urine, when in reality there is a pyelonephritis and the albumin is due mainly to pus. The pressure of the pregnant uterus upon the ureters causes obstruction, thus giving rise to stasis, which as you all know, predisposes to infection. The same condition is brought about by pressure of a tumor or stricture of the ureter and as stricture of the ureter is of such frequent occurrence, I am strongly of the opinion that it is responsible for a large percentage of the cases of pyelonephritis of pregnancy,

The weight of the heavy uterus, added to its snug fit at the pelvic brim, causes a constant pressure on the ureters, which may produce an area of inflammation and pressure necrosis. Should ulceration or sloughing occur, healing would result in scar tissue formation and cicatricial contractions, thus giving rise to a true stricture of the ureter.

The nourishment of the child and elimination of its waste prod-

ucts, naturally tends to deplete the mother's resistance and with the added strain put on her kidneys by back pressure from stasis, it is difficult to understand why pyelonephritis of pregnancy is not of more frequent occurrence.

Gilbert J. Thomas (3) says pyelitis of pregnancy is an acute exacerbation of an already present chronic pyelonephritis. Foci of infection are easily found. Before going to term, pregnant women should have all infected teeth and other possible foci of infection removed.

PYELONEPHRITIS FOLLOWING OPERATION

Pyelonephritis following operation, is often due to the fact that a preëxisting kidney infection has been overlooked; but in those cases in which retention and catheterization has occurred, the portal of entry for the infection is easily accounted for. Although most cases of kidney infection are hematogenous in origin, I have always believed that in some cases infection travelled up the ureter from the bladder. This has now been definitely proven by the recent experiments of Graves and Davidoff (4), so I am convinced that where the general resistance is lowered, e.g., following operation, an infection of the bladder may travel up the ureter, or by way of the blood stream and produce a pyelonephritis. It therefore, behooves us to see that our patients are catheterized under the strictest aseptic precautions in order to minimize the danger from this source.

PYELONEPHRITIS OF STASIS

This is one of the most frequent of all causes of kidney infection, for whether the stasis is due to diminution of the caliber of the ureter from within, e.g., stricture, or from without, e.g., pressure of a tumor, or from a kink, e.g., floating kidney, the ultimate result is the same. Hunner (5) says, stricture is due to focal infection and this in many instances is true, but that it is the primary lesion in every case, there is grave doubt.

We all know that focal infection is responsible for many cases of kidney infection, if this be true, then why may not the infec-

tious material descending the ureter, cause inflammatory thickening and ulceration of its walls with resultant stricture formation? The stricture thus being secondary to the kidney involvement. I agree fully with Hunner that stricture of the ureter is of very frequent occurrence, but that it is the primary condition upon which most infectious kidney pathology is dependent, is open to grave doubt.

PYELONEPHRITIS OF OVERWHELMING BACTERIAL INVASION OR DIMINISHED KIDNEY RESISTANCE

It is an established fact that pyogenic bacteria are daily eliminated by the healthy kidney without damage. If however, the dosage becomes too large or the resistance of the kidney is lowered, infection may soon result.

This increase in dosage may be due to focal infection or where there has been focal infection, with which the kidney has been able to cope (e.g., abscessed teeth), the overwhelming invasion may be produced by the opening up of too many absorptive areas by the extraction of the affected teeth.

I saw this strikingly demonstrated recently in a woman thirty-eight years of age, who had a fulminating pyelonephritis following the extraction of an abscessed tooth, which had been removed, as the focus of a neuritis. The dentist sutured the gum, thus preventing drainage and causing an overwhelming dose of bacteria to be thrown into the circulation, which proved too much for the kidneys that had been eliminating a small dosage for months, without becoming involved.

The prostate and vesicles too, are frequent sources of focal infection and under excesses of venery or drinking may send an overwhelming dose of infection to the kidneys. Diminished kidney resistance may be produced by any condition that tends to cause congestion or misplacement of the kidney, or interference with proper drainage.

Kidd (6) in his work, "Common infections of the kidney," lays great stress on widely advertised drastic purgatives as a predisposing cause of pyelitis and also cites fatigue, worry and sudden chilling as factors lowering kidney resistance.

Intestinal infection must not be overlooked, for here is the normal habitat of the colon bacillus and as you know this organism is responsible for the greatest number of kidney infections. Hemorrhoids, the almost universal complaint, unless causing discomfort, is overlooked although their ulcerating surface or the proctitis which so often accompanies them, may be the portal of entry of the overwhelming invasion.

TREATMENT OF PYELONEPHRITIS

The treatment of pyelonephritis from whatever cause, devolves itself under the following heads: (*a*) Check the invasion of bacteria by promoting drainage by ureteral catheterization and free diuresis, (*b*) build up resistance, (*c*) prevent stasis, (*d*) eradicate the focus.

Some authorities do not advocate immediate catheterization. This seems ill advised to me, for it stands to reason that the drainage of the infectious material from the kidney pelvis serves a two-fold purpose in preventing reabsorption and aiding in elimination, especially is this true in the cases complicated by stasis. The passage of a ureteral catheter into each pelvis and its retention, supplemented by the injection of sufficient saline to keep the lumen clear and the drainage free, is the one best aid in the treatment of acute kidney infections. Alkalization and large quantities of water by mouth, by vein, subcutaneously and by rectum too, plays an important part in promoting diuresis and combating acidosis. Many cases of pyelonephritis will be relieved of their acute symptoms by this means alone. Unfortunately the sense of well being that often follows, lulls the patient and his physician into a false sense of security and due to the absence of appreciable symptoms, severe kidney pathology may persist with dire consequences to the unfortunate victim. Therefore, it is of paramount importance that these cases, regardless of their freedom from symptoms, should be subjected to a complete urological examination.

The choice of the solution for pelvic lavage is immaterial, as I am convinced that the chief benefit derived from pelvic lavage is due to the promotion of drainage. Silver nitrate, however,

has proved more efficacious in my hands than any other I have tried. I do not use it however, in the acute cases, but rather rely on drainage through the retained catheter plus saline injections as already described.

Build up resistance. This is best accomplished by the intravenous injection of a foreign proteid and typhoid vaccine answers the purpose satisfactorily. For the first dose I give one minim of vaccine in nine minims of saline. If there is no reaction and only slight improvement in twenty-four hours, I do not hesitate to give two minims. There is usually a severe reaction following the administration of this material, consisting of a rigor, high fever and profuse sweating, sometimes delirium and a rapid and weak pulse. I have never seen any serious results following its administration, despite the fact that I have used it in a case of pyelonephritis complicated by septic endocarditis. Its action seems to be that of a stimulant to the leucocytes and antibodies or to an increase in their number, thus giving the patient sufficient resistance to combat the systematic infection. As yet I have seen no effect on the process in the kidney. We are now conducting a series of blood counts before and after the injection in order to determine its effect, but are not ready to make any definite statement at present. However, we believe that in the cases that show a definite improvement, there is an increase in the leucocyte count, while in those which fail to respond, the leucocyte count remains stationary or falls slightly. I will report our ultimate findings at a later date.

My experience with mercurochrome intravenously, has been similar to that of typhoid vaccine, except that some of the reactions have been of extreme severity. It has had no effect on the local process in the kidney, with one exception and this was a case of typhoid fever with a pyelonephritis, due to Eberth's bacillus, but as retention catheters and pelvic lavage were also used, I am loth to give the entire credit to the mercurochrome alone. Three injections of 20 cc. each of mercurochrome one per cent were given at forty-eight-hour intervals with the most astounding results on the typhoid fever and with a rapid elimination of the pus and bacilli from the kidneys. I think any foreign

proteid will act equally as well as typhoid vaccine, but as this has been so satisfactory I see no reason to change.

After the acute symptoms subside, vaccines subcutaneously or intramuscularly have in some cases seemed of distinct benefit, while in others there has been no appreciable effect. I see no advantage in autogenous over stock vaccines.

The correction of stasis. Floating or movable kidneys should be supported by a belt and if unsatisfactory, nephropexy should be done. Strictures of the ureter should be dilated and stenosed ureteral orifices incised with cystoscopic scissors. Ureteral calculi should be removed by cystoscopic or surgical means and the stasis from bladder neck obstruction or stricture of the urethra relieved by appropriate operative procedures.

Eradicate the focus. This is not always an easy matter, for it is often difficult to definitely locate the focus of infection. Teeth, gums, tonsils, sinuses, gall bladder, appendix, colon, rectum and last but not least, prostate and seminal vesicles should all be subjected to the most searching investigation. Dead teeth with no infection about their roots are nevertheless objects of suspicion, for they are at least potential sources of infection and should be removed. The prostate and vesicles are often overlooked, especially in the absence of venereal history and yet are frequently the seat of active colon, staphylococcic and streptococcic infection.

CONCLUSIONS

1. Pyelonephritis is the usual type of renal infection rather than pyelitis.
2. Prevention should be the keynote rather than cure.
3. Check the invasion of bacteria and drainage offer the best means of relief followed by removal of the focus for permanent cure.
4. Typhoid vaccine intravenously is a valuable and safe aid in checking systematic involvement.

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PYELITIS IN PREGNANCY

HOMER G. FULLER

Washington, D. C.

The pregnant woman is subjected to various discomforts and dangers—some related to the altered or increased demands made upon the metabolic functions, others dependent upon the changed mechanical conditions imposed by the growing fetus. Certain changes in the urinary function are so constant as to be considered physiologic or, at least, a functional norm of the pregnant state. That the albuminuria of pregnancy is based on metabolic changes is hardly debatable, even though some lesion of the glomerular or tubular epithelium is implied by the presence of albumin in the urine. The pyelitis of pregnancy, on the other hand, is not a constant accompaniment of the child-bearing state. Pyelitis may be produced by pathogenic microörganisms, principally by colon bacilli, staphylococci and streptococci, which are either transported to the kidney by the blood stream or lymph, or ascend to the renal pelvis from the infected lower urinary tract, possibly contingent upon dilatation and antiperistaltic action of the ureter. Usually, however, pyelitis of pregnancy is excited by some interference with normal urinary flow, such interference being referable primarily to obstructive causes, particularly to reduction of the lumen of the ureter (especially the right) by mechanical pressure of the uterus or other organs, or a pressure so often found located at the pelvic brim, or to obstruction by calculi or by the sequels of ureteral inflammation and infection. When the flow of urine from the renal pelvis is arrested by constriction or obstruction of the ureter, the stagnant urine furnishes a medium for the development of pathogenic microörganisms, the toxins of which, together with the products of urinary decomposition, establish an inflammatory condition. In by far the larger number of cases of pyelitis of pregnancy that form

the basis of this paper the obstruction was found to be at the brim of the pelvis.

The damming back of the urine in the renal pelvis can be efficaciously combated by expert ureteral catheterization, as has been set forth by Stoeckel, Caulk, Eisendrath and many others. The first urine issuing from the catheter is oft times quite clear while that at the end we have often found to be so thick as to hardly pass through the catheter. The principle of this method of treatment, introduced when Stoeckel demonstrated the value of pelvic lavage, has greatly modified modern urological and gynecologic practice. Ureteral drainage alone will often suffice to relieve all the symptoms of pyelitis, most of which are produced by the blocking up of the ureter, particularly if the renal pelvis and ureter are not excessively dilated. Ordinarily, however, the presence of infection or of marked dilatation makes the institution of pelvic lavage the logical supplement to ureteral catheterization. The pelvic irrigations may be made with sodium chloride or boric acid solution, or, to check up the infection more rapidly, silver nitrate, mercurochrome, acriflavine or some other germicidal agent may be used in solution of suitable concentration. The ureteral catheterization and pelvic lavage should be continued as long as evidences of infection persist in the urine.

Rest in bed and free administration of fluids are naturally indicated in the acute stage of pyelitis which usually lasts about a week.

To forestall some of the possibilities of recurrence of pyelitis from fetal pressure after catheterization and lavage, the patient is instructed to assume the knee-chest position for short periods three or four times a day. In obstinate cases of ureteral obstruction, an indwelling or retention catheter as suggested by some (Rush recommends only a roentgenologic lead catheter) will maintain free drainage from the renal pelvis. Such a catheter has been retained for as long as twenty-six days without becoming encrusted with urinary deposits and without untoward sequels.

I desire to lay great stress on the importance of the patients being made to assume the knee-chest posture as an adjunct to

ureteral catheterization and kidney lavage. Thus we permit the gravid uterus to fall forward away from the pelvic brim relieving the pressure at the pelvic brim, permitting an uninterrupted passage of the urine from the kidney to the bladder, thereby bringing about a frequent drainage of the kidney pelvis. This is obviously most essential, and we should and do see that the patient has advantage of this postural change every two hours during the day, and every four hours at night, until real improvement ensues. It has been our observation that we get vastly different results in those cases which rigidly adhere to this advice. This is demonstrated in subsequent ureteral cathetcerization when the amount of retention is so much less and the character of the very last urine collected, instead of being thick with pus, is of the same character as that first escaping.

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DISCUSSION

Dr. HUGH H. YOUNG (Baltimore): I think that we owe Dr. Patch a debt of gratitude for bringing up this subject, which has not been discussed in American literature very much. Those 2 cases of mine that he refers to were extremely interesting cases on account of the length of time that these people had had typhoid infections of the kidney, and with practically no symptoms. One man was a prominent bank official, who for eight years had been holding down a very prominent job and was carrying a huge typhoid kidney on the left side, the kidney being 8 or 10 inches in diameter. The typhoid bacillus was the only organism present. The other man had also had pyuria for eight years. We found typhoid bacilli in the urine and at operation we found stones containing typhoid germs in the center of them. He was a milkman, and naturally I suppose, spreading typhoid fever wherever he went. At any rate, he was certainly a very dangerous individual to be a milkman. I agree with you thoroughly that they are among the most dangerous typhoid carriers there are, and I believe if we got very careful differential studies, we would find more typhoid chronic infections than we do. So many things are put down as B. coli, that I think that is the reason more have not been discovered.

Our experiments with mercurochrome would indicate that it ought to be a very important drug to use in the treatment of typhoid carriers. Several have already been cured by intravenous injections of mercurochrome, 5 mgm. per kilogram. The fact that mercurochrome is eliminated through the bile ducts should make it particularly valuable in cases of typhoid of biliary character.

Dr. HARRY CULVER (Chicago): I have had 2 patients in the past year, during the typhoid epidemic, with right sided typhoid pyelonephritis; a small amount of pus and typhoid bacilli were

obtained from each kidney. One patient was kept in the hospital for six weeks and all known urinary antiseptics were used to disinfect the urine. Two negative cultures are necessary before patients are discharged from the hospital. The other patient was likewise treated for eight weeks without result. One pelvic lavage with silver nitrate in one instance and two pelvic lavages in the other patient and we were able to discharge both patients with sterile urine.

Dr. GILBERT J. THOMAS (Minneapolis): I wish to report another case of typhoid infection of the kidney. This occurred in a physician, a member of our Department of Pathology, of the University of Minnesota. His first attack occurred when he was twenty-three years of age.

He had five attacks of renal pain with chills and fever. Each time that he was cystoscoped, we found typhoid bacilli from the affected kidney. The organisms were tested in the usual manner by the patient, who is a laboratory worker so that they were properly identified. Each time that the patient was cystoscoped, he had complete anuria. The first time, the anuria was relieved by permanent catheterization of the affected kidney. No definite obstruction was found in the ureter. The second time—the patient refused catheterization and went forty-eight hours without passing urine. Following this nephrectomy was done. A large pyonephrosis was found which was not as large as the one in Dr. Patch's picture. There was no discoverable reason for the pain history or the apparent obstruction in the ureter.

The patient was operated by one of his friends, a general surgeon, who did not at the time of operation explore carefully for an anomalous vessel. It would seem that some obstruction should have been present with this history.

Concerning Dr. Barney's work, I think the early diagnosis of renal tuberculosis is tremendously interesting and important. At the present time, as I stated yesterday, I have an opportunity of studying tuberculosis in a large sanatorium where we have between 500 and 600 patients. We are routinely examining the urine and the urinary tract. This consists in injecting the

catheterized bladder urine into animals. We cystoscope the patient. If any pus or albumin is found in the urine, bilateral pyelograms are made, and it is quite remarkable, the frequency with which we find tiny cortical abscesses, indicating involvement in one or both kidneys. It is also remarkable that our percentage of bilateral infection is gradually increasing so that at the present time we have 41 per cent of about 102 or 103 cases that show by pyelograms or after guinea-pig inoculation, a bilateral renal tuberculosis.

I have some slides which show the early lesions as revealed by the pyelogram but time will not permit me to show these at this time. One of these slides contains the pyelograms of both kidneys of a patient who is now under observation. The pyelograms are entirely negative but the patient has tubercle organisms in the catheterized urine from each kidney. Guinea pigs have been repeatedly injected.

From my experience I find it necessary to inject the urine as obtained with the ureteral catheter into guinea pigs repeatedly before I may be sure that a kidney does not contain tuberculosis.

Dr. David W. MacKenzie (Montreal): I also want to compliment Dr. Patch on his series of cases, so well worked up; and to mention 2 cases which we reported in 1921, and 1 last year, and 1 we have had since—4 cases. Only one had a clinical history of ever having had typhoid. One of them, in our first list, a woman, a cook, gave a history of being through three epidemics of typhoid, and since our examination she returned to the surgical service and had a gall-bladder removed from which a pure culture of typhoid bacilli was obtained.

I also, in regard to Dr. Barney's paper, wish to report a miserable conundrum I had myself, not very long ago. A girl eighteen years old with pulmonary tuberculosis healed. No pus nor tubercle bacilli were at any time found in the urine but on four cystoscopies, two in another clinic six months apart, and two in ours four months apart, the guinea pig inoculated from the right kidney died of tuberculosis while all four from left kidney remained healthy. Was persuaded to remove right kidney but found no lesion.

Dr. JAMES A. GARDNER (Buffalo): I wish to congratulate Dr. Patch upon his paper, and to emphasize what Dr. Young has said about the care of the laboratory in checking up cultures. Certainly in my own practice I know that we have been somewhat careless about the culture during the past couple of years. There have been many times when we wished to pin down the laboratory as to just what a culture was, when they stated that there had been a contamination and they could not report definitely. Careful attention to details I am sure has been given by Dr. Patch and others who have reported these cases which has enabled them to find the cause.

Dr. NATHANIEL P. RATHBUN (Brooklyn): I should like to briefly cite one possible source of error which probably should not occur in any well regulated clinic. It might occur in any clinic. It certainly occurred once several years ago in my clinic.

This was a man with unilateral pyuria. We had, as a matter of routine, inoculated the guinea pig. It developed in x-ray that there was a calculous pyonephrosis. There was some interval between diagnosis and operation. In the meantime the pathologist reported that the guinea pig had died with tuberculosis. We were rather surprised at that.

At operation, we removed the kidney and carefully searched for it, and found no evidence of tuberculosis at all. We very naturally delved into this mystery and finally, after considerable investigation in the laboratory, satisfied ourselves that this particular pig had been inoculated before, and it lived for a couple of months and gained weight and was apparently in perfectly good health; was turned back into the herd and was inoculated again with my patient's urine. It was interesting that the pig could live as long as he did, with no evidence of tuberculosis, and then be activated apparently by this second infection of urine.

The practical answer to that is that every pig that is inoculated should be sacrificed.

Dr. FRANK S. PATCH (Montreal): I merely wish to remark that Dr. Young's article, together with the later ones of Melchior, constitute the most important contributions to the literature of typhoid infections of the kidney. The Teutonic contribution, however, shows a characteristic disregard of the literature of this continent, and makes no mention of Dr. Young's cases.

Dr. GEORGE R. LIVERMORE (Memphis): I just wanted to add that the case of typhoid that we reported yesterday was in this paper, and the complete relief of the typhoid fever, plus the cleaning up of Eberth's bacillus from the kidney by the intravenous injection of three doses of mercurochrome, 1 per cent 20 cc. each, at forty-eight-hour intervals.

MEMORIAL TO EDWARD L. KEYES, A.M., M.D., LL.D., K.S.G.

1842–1924

Mr. President and Fellow Members:

It is of profound interest, and a matter of historical importance, that in the death of Dr. Edward Lawrence Keyes, this Association lost its first President, who was an original charter and active member for twenty years; and from 1906 an honorary member, a total period of membership covering nearly forty years. In his official capacity he presided here in Washington, at the initial meeting of the Association as an integral part of the Congress of American Physicians and Surgeons. Inasmuch as this is the first Congressional Convention following his decease it seems most fitting that a suitable memorial in his honor be proposed and, moreover, that its presentation should be the privilege of one whose personal debt of gratitude is no less than that of the organization he helped to found and develop.

As a founder of this Association Dr. Keyes' influence was always toward ideals of the highest type and, in his active day, he was one of, if not *the* foremost representative of the branch of Genito-Urinary Surgery. As he endeavored to elevate the practice of this special department, so did he by example as well as counsel imbue this body with a spirit of superior aim that we who come after should not fail to propagate.

I submit, Mr. President, the following:

WHEREAS, In the death of Dr. Edward Lawrence Keyes of New York, the American Association of Genito-Urinary Surgeons has lost the founder, in whose home the Association came into being, and an original member with whose professional career the development of American genito-urinary surgery is closely interwoven; therefore, be it

Resolved That this Association desires to express its appreciation of Dr. Keyes as a physician of broadest humanitarianism, a scholar whose

keen intellect commanded the respect, as his kindly nature won the affection of his associates, and to record its loss of an element in the life of the Association which cannot be fully expressed by words; and further be it

Resolved That these resolutions be spread upon the minutes of the Association and that hereby we express the hope that we who follow him may share in the fulfilment of his ideals.

CHARLES H. CHETWOOD.

Mr. President and Fellow Members:

It is difficult to briefly summarize the accomplishments and graces of such a man as the founder and first president of the American Association of Genito-Urinary Surgeons. Dr. Keyes, Senior, as in his later years, was affectionately and reverently known to American urologists, was born at Fort Moultrie, Charleston, S. C. He was the son of Caroline and Erasmus Darwin Keys. His father was a general in the United States Army and descended from an old New England family. Dr. Keyes died of pneumonia after a brief illness on January 24th, 1924.

He graduated from Yale University in 1863, and entered the United States Army with the rank of captain as an aid to his father. Later he resigned from the army and entered New York University Medical College, graduating in 1866. He studied abroad for a year and on his return to New York was appointed lecturer on Dermatology at Bellvue Hospital Medical College. The first course on dermatology in the United States was given in 1870 by Dr. Keyes. He became professor of Dermatology at the Woman's Medical College in 1870 and in 1870 was made professor of Dermatology, Syphilology and Genito-urinary Surgery in the Bellvue Hospital Medical College. Following 1871 he served several years as visiting surgeon to Charity Hospital (now the City Hospital) and also for many years was visiting surgeon to Bellvue Hospital, and on severing active relations with these institutions, continued as consulting surgeon to each of them until the time of his death. At Bellvue Hospital he established the first ward in the United States devoted exclusively

to genito-urinary surgery. He was the principal contributor to the text of VanBuren and Keyes' work on Genito-urinary Diseases and Syphilis in 1874, and the author of subsequent revised editions appearing under his own name after the death of his associate, Dr. VanBuren, and had the unusual privilege during his life time of having this nationally used text book as a standard for our medical schools for fifty years under his own and the subsubsequent editorship of his son, Dr. Edward L. Keyes, Jr.

He wrote the section on urinary calculus in Ashurst's Encyclopedia of Surgery and had contributed constantly to the current medical literature of his day. His method of treating syphilis, as outlined in his brochure entitled "The Tonic Treatment of Syphilis," established a therapeutic standard following its publication in 1877 which was the accepted method of treatment for thirty years or more, and his many contributions to the literature covering his long career are too well known to need enumeration.

He received the degree of A.M. from Yale University and that of LL.D. from the college of St. Francis Xavier, and Pope Pius X conferred on him knighthood in the order of St. Gregory.

The American Association of Genito-urinary Surgeons is indebted to Dr. Keyes not only as its principal organizer and first president, but as being one of the very first in America, by his writings and otherwise, to define the scope and emphasize the importance of genito-urinary surgery as a specialty. He had breadth of understanding, executive ability, and an interest in and comprehension of the needs of his profession that constituted a high order of what it may be justifiable to designate as medical statesmanship. His utterances carried the conviction of sincerity. His opinions were accepted by the profession as the matured product of capable and entirely honest investigation. His discussions at medical meetings and in the class room were always in simple words and there was a personal charm and clearness of expression that was unusual. His passing closed a career of notable achievement that was well sustained and increasingly widened to the end of a long and active life.

WILLIAM N. WISHARD.